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Building A Radio Console—Page 652

25 CENT

POPULAR MECHANICS MAGAZI

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REG'D TRADE MARK, GREAT BRITAIN, No. 410426

SEE PAGE 533

It takes only Weeks for a Big Pay Job

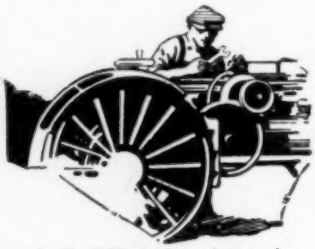
George W. Smith runs a big Ford Agency and Repair Shop at West Alexandria, Ohio. He says, "I am clearing over $800 per month."

My method is the shortest successful system ever known for training **Big Salary** men. J. H. McSWEENY President.

Read what these men are doing in the Auto, Tractor and Electrical Business. Here is your big chance to get "on easy street." Come to the great McSweeny Shops on the biggest Special Offer ever made.

Big Firms Need Trained Men

The Auto, Tractor and Electrical Business is on the boom. Thousands of trained men will be needed during the next few months. I get calls every day from Garages, Battery Stations, Auto Repair Shops and other **successful** concerns for McSweeny men. When the big fellows need high-grade men, they know where to come for them.



C. E. Gillispie has charge of a fleet of trucks and tractors with the State Highway Commission, due to McSweeny training.

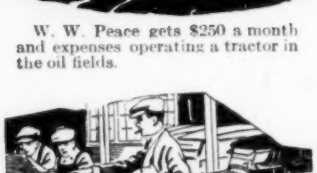
McSweeny Trained Men Earn $75 to $150 Weekly

Scientific tool training—that's the secret. You do things here according to the latest engineering standards. Thousands of dollars have been spent in modern tools and equipment. That's why my men are at home in the biggest shops in the country. If you want to succeed the way Smith and Collins and the rest have—qualify by the same method.

W. W. Peace gets $250 a month and expenses operating a tractor in the oil fields.

I'll Pay Your Railroad Fare and Board You

In order to fill the openings that now exist, I am making an offer no one has ever made before—**Free railroad fare, Free board.** But even that is not all. I'll tell you about the rest in my letter.



D. M. Collins, Williamsville, West Virginia, writes, "Shortly after finishing McSweeny training, I started in as manager of a garage at $300 per month."

Send for FREE Book

My big illustrated training book tells how others are succeeding. It tells many things you ought to know about Autos and Tractors. Write for it and my **short time** offer NOW. It soon expires.

McSWEENY

Auto Tractor and Electrical

TRAINING SHOPS

CINCINNATI
9th and Walnut

CHICAGO
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Mail this coupon

McSweeny Auto, Tractor and Electrical Training Shops,
Dept. 149 (Address shops nearest you)
Cincinnati, O., or Chicago, Ill.,

Without any obligation send me your big free book on Autos. Also information regarding special temporary offer.

Name_____

Street_____

City_____ State_____

SEE PAGE 533

"Your radio is always top notch. What do you do to keep it so full of pep?"

KEEPING your "B" batteries full of pep, without frequent renewals, is simply a matter of using the right size Evereadys for your particular set with a "C" battery*.

The rule which determines the right size "B" batteries to use is simple, and once learned definitely settles the question of "B" battery service and economy.

On 1 to 3 tubes—Use Eveready No. 772.
On 4 or more tubes—Use the Heavy Duty "B" Batteries, either No. 770, or the even longer-lived Eveready Layerbilt No. 486.
On all but single tube sets — Use a "C" battery.

When following these rules, No. 772, on 1 to 3 tube sets, will last for a year or more; and Heavy Duties, on sets of 4 or more tubes, for 8 months or longer.

These life figures are based on the established fact that the average year-round use of a set is 2 hours a day.

A pair of Eveready No. 772's for a 5-tube set instead of 2 Eveready No. 770's or 2 Eveready Layerbilts No. 486—looks at first glance like an economy because of lower first cost. But in a few months the 772's will be exhausted and have to be replaced. After the same length of time the Eveready No 770's or the Eveready Layerbilts No. 486 will still be good for many more months of service.

We have prepared for your individual use a new booklet, "Choosing and Using the Right Radio Batteries," which we will be glad to send you upon request. This booklet also tells about the proper battery equipment for use with the new power tubes.

*NOTE: In addition to the increased life which an Eveready "C" Battery gives to your "B" batteries, it will add a quality of reception unobtainable without it.

Manufactured and guaranteed by
NATIONAL CARBON CO., Inc.
New York San Francisco
Canadian National Carbon Co., Limited, Toronto, Ontario

LEFT—*No. 486, for 4, 5 or more tubes.* $5.50

RIGHT—*Eveready Dry Cell Radio "A" Battery, 1½ volts.*

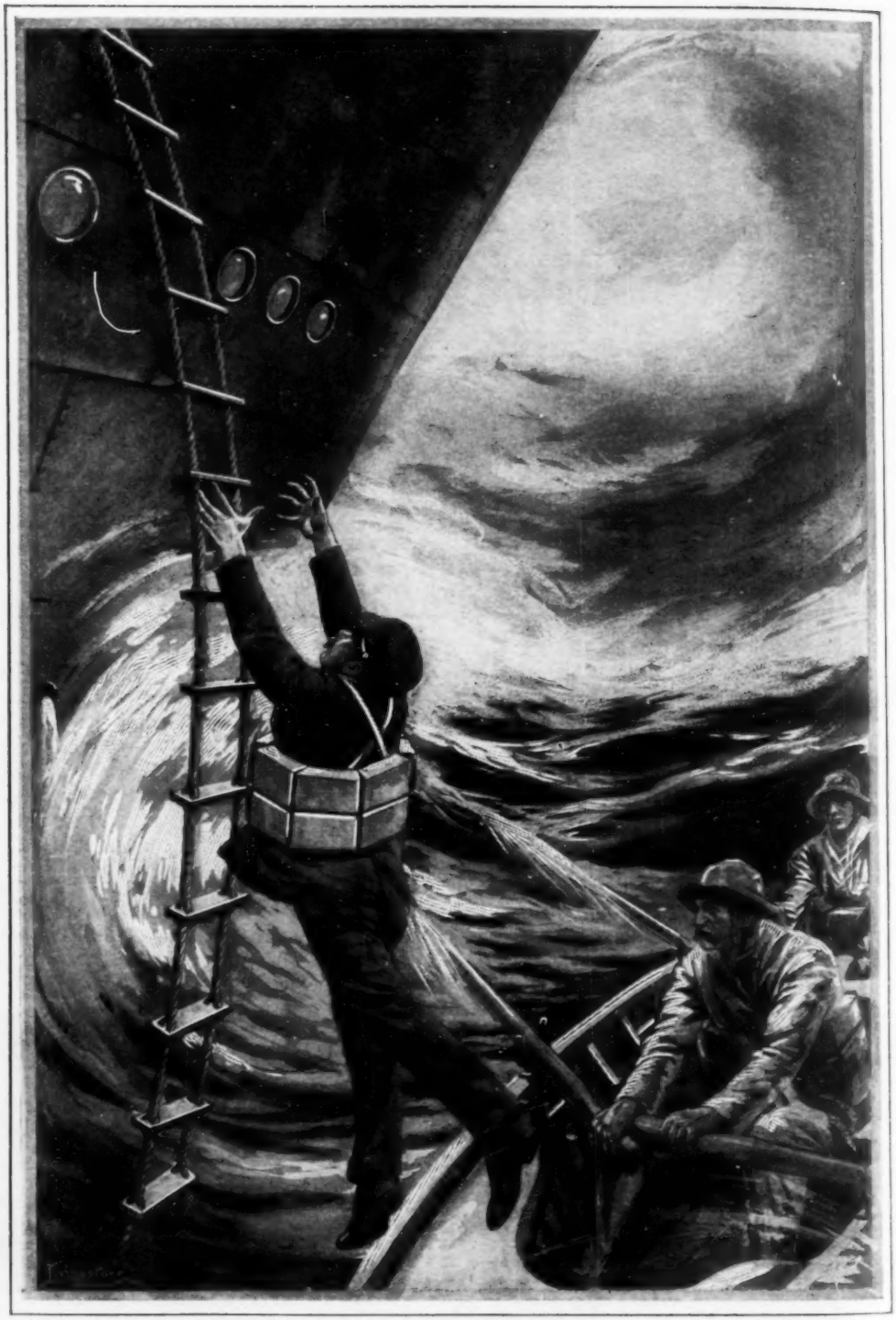
EVEREADY
Radio Batteries
—they last longer

Tuesday night means Eveready Hour —9 P. M., Eastern Standard Time, through the following stations:

WEAF—*New York*	WSAI—*Cincinnati*
WJAR—*Providence*	WEAR—*Cleveland*
WEEI—*Boston*	WWJ—*Detroit*
WTAG—*Worchester*	WGN—*Chicago*
WFI—*Philadelphia*	WOC—*Davenport*
WGR—*Buffalo*	WCCO—*Minn.* *St. Paul*
WCAE—*Pittsburgh*	

KSD—*St. Louis*

Pacific Coast, Eveready Program
KGO—*San Francisco, 8 to 9 P. M.*



A Sandy Hook Pilot Leaping from His Small Gig for the Jacob's Ladder of a Giant Inbound Liner during a Wild Wintry Gale, a Perilous Procedure—See Page 539

Popular Mechanics Magazine
REGISTERED IN U. S. PATENT OFFICE
WRITTEN SO YOU CAN UNDERSTAND IT

Vol. 45 APRIL, 1926 No. 4

Sunspot Weather Prophets Vindicated

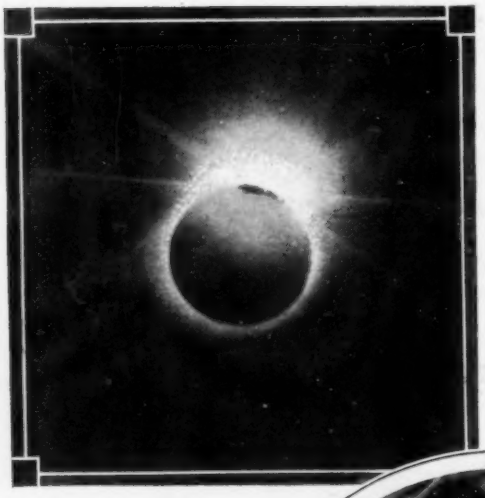
Storms and Disturbances They Forecast Arrive on Schedule, but Whether Their Theory Is True Remains to Be Proven

WEATHER prophets who forecast storms and intense cold for the past winter on the basis of sunspot activity during the last three years apparently have been vindicated, and it now remains to be seen whether the prophecy of a short and cool summer for 1926 will be fulfilled.

That sunspots influence the earth's weather, as well as magnetic, electric and other atmospheric conditions, has been conceded for some time by most scientists, but the extent to which the known sunspot cycles can be used to foretell weather months or even years in advance remains to be seen.

The weather changes which followed the increased sunspot activity in late November and early December, however, left nothing for their most ardent devotee to desire. Sudden and sharp spells of intense cold, alternating with unseasonal mildness, excessive rains, showers of meteorites, unusually large displays of the northern lights, considerable volcanic activity abroad, and widespread and disastrous floods in England, France, Germany, Holland and Belgium were only a few of the more outstanding developments. Why the spots which astronomers find at more or less regular intervals may affect weather on the earth is an interesting topic. The cause lies in the decrease in solar energy transmitted by the sun to the earth. The spots are caused by cyclonic storms sweeping across the sun's surface. The storm is reflected at the margin of the sun by a vortex, or anti-cyclone, representing the axis of a high-pressure area. The disturbance of the sun's atmosphere by the storms is accompanied by displacement due to the fact that the outer portion is cooler, and as it moves downward it disturbs the equilibrium, producing greater density at the base of the column. Long tongues of flame sweep out 250,000 to 300,000 miles past the sun's corona at almost unimaginable speed, while the center of the cyclonic storm appears in the astronomer's telescope as a vast black spot. Some of these storm centers are 50,000 miles or more across, and with their great size the resulting change in the amount of solar heat reaching the earth is quite marked. As the sun revolves, the

Naval Astronomers at the Washington Observatory with Part of the Camera Set Up to Photograph Sunspots



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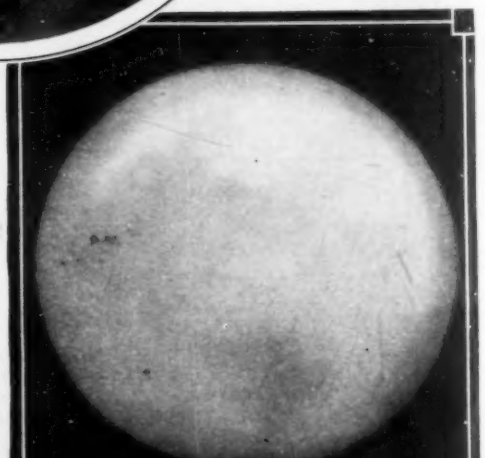
Gas Flames, Millions of Miles Long, Forming the Sun's Corona, as Photographed during the Eclipse a Year Ago; the Moon Is in Front; Eyepiece of a Great Telescope, and a Group of Sunspots, 175,000 Miles Long, near the Sun's Equator

spots sweep across it reaching a maximum intensity in from ten to twelve days, and gradually decreasing as they pass on toward the opposite side.

The periods in which the spots appear are variable, but are constantly growing shorter. The last minimum of sunspot activity was in 1923 and the next is due in 1929, if the six-eleven cycle continues true. The astronomical records show that the periods of maximum activity may be expected every eleven and three-tenths year, with periods of minimum activity within that period. British weather experts have found that in 1865, and for twenty-five years thereafter, every fifth year in England was wet, and that these years coincided with sunspot activity. Then the flames began to appear oftener, and during the next quarter of a century every third year was wet. Between 1910 and 1921 the spots were still more frequent and alternate years were wet and dry. In 1921, there was a drought, and this apparently marked another change in the sunspot cycles, so that a new one is now being established.

A similar study of drought periods in southern California shows that there were floods in 1862, droughts in the seventies, the greatest rainfall ever recorded there in 1889; the driest period in 1898-99; another heavy-rainfall year in 1914, and that 1924 was the driest since 1898. Thus the first period from 1862 to 1889 was twenty-seven years; the period of dryness, 1872 to 1898, was twenty-six years; the second wet extremes covered twenty-five years, and the final dry limits were twenty-six years apart, so that the average was close to twenty-six years for the extremes of the interlocking wet and dry periods, and this figure apparently marks the limits of the weather cycles for that locality. Studies in Australia indicate a weather cycle of between eighteen and twenty years, and the figures for India are virtually the same. This apparently indicates that weather cycles differ with the locality, but the same basic factors govern all of them.

A California observer, Father J. S. Ricart of Santa Clara, has advanced the idea that there is a relation between the sunspot periods, the weather cycles, and the conjunction of the planets Saturn and Jupiter. Like the drought cycles of



Australia, India and Africa, this occurs every twenty years. As the average drought period is three years, he brings California into his theory by adding the two periods at either end to the twenty-year cycle, giving the twenty-six-years average. The conjunction of the planets, he believes, causes an abnormal fall of meteoric matter on the equatorial region of the sun, causing an enormous generation of heat, which, rising in the form of metallic gases, obscures the solar storms. In such periods, when the planets are in conjunction, we see few sunspots, but we do feel the excess heat from the sun, and a hot, dry year is experienced. Ten years later there will be an opposition of the same planets, and a smaller demonstration of the same sort. In the years between, according to this theory, there is a smaller fall of foreign matter onto the sun, and consequently the cyclonic storms which sweep across it are more visible, produce greater changes in solar radiation and we get the effect in cooler years and more rainfall.

The possibility of the sun storms and changes being due to electrical or magnetic effects produced by the movements of other planets has been studied, but the study is still in its infancy. Storms and other unusual occurrences on earth are the aftermath, apparently, of electrical disturbances, but as they are the result, it is hardly possible to learn much of their origin from them, since the original cause has already been dissipated.

Much progress has been made in the last two decades toward relating the cause and effect of storms on earth and solar phenomena, and scientists hope that, some day, they will solve both questions so thoroughly that the earth's weather can be forecast well in advance. That solution, however, may not come within the next hundred years, so slow is the progress toward checking observations already made. If Father Ricart's theory is correct, years of extreme drought will come in 1941, 1961, 1981, 2001, 2021, and so on, in connection with the conjunction of Jupiter and Saturn, while minor droughts will mark 1931, 1951, 1971, 1991 and corresponding years later on. To prove or disprove that theory beyond a doubt will take more than the lifetime of anyone now living.

CHANGES OF COLOR IN LEAVES LAID TO ALCOHOL

Fermentation, which allows the red and yellow pigments to develop, is partly the reason that leaves change their color in the fall, according to eastern scientists. By measuring the amount of light reflected from the leaves at different stages in their life, they have discovered that, during the summer, about ninety per cent of the sun's illumination is absorbed, but in the fall most of it is shut out. This retards their growth, fermentation sets in, the alcohol absorbs the green elements and the bright reds, yellows and other shades appear.

Studying Leaves to Find Out Why They Change Color; Scientists Ascribe It Partly to Fermentation

HOLDER FOR DRIVER'S LICENSE FITS AUTO-KEY RING

Attached to the ring that holds the automobile ignition keys, a tube with a lock cover, keeps the driver's license where it is handy for inspection at any time desired and is not likely to get lost. The extra member with the keys also reduces the likelihood of mislaying or losing them, yet the tube is not large enough to hinder the driver in locking his car.

Using Spring on Phone and Electric-Iron Cords

SPRING FOR ELECTRIC CORDS PREVENTS TWISTING

Cords connecting the electric iron, the telephone or other instruments, are kept from knotting, breaking and getting in the way by a steel-spring section that takes up useless slack, holds the cord firmly so that it cannot twist and yet allows sufficient give to permit full use of the article to which it is attached. By protecting the insulation and outer covering, it reduces the probability of short circuits and the attendant danger of fire.

HALF OF WOMEN ON FARMS DRIVE AUTOMOBILES

Survey of farm-home conditions in sixteen middle-western states reveals that more than fifty per cent of the women in the district drive automobiles. On the other hand, more than sixty-seven per cent still draw water from wells or pumps outside the house, and less than twenty-eight per cent have sinks with drains in the kitchen. Less than eighteen per cent of the homes surveyed had bathtubs; there were washing machines in more than forty per cent of the homes, and in nearly seventeen per cent, the washers were run from the farm-power system. Only a little more than eleven per cent of the farm wives kept any kind of record of their expenditures.

OLD RESERVOIR AS THEATER HAS THREE-LEVEL STAGE

With a seating capacity of 5,000 persons, an open-air theater constructed from an abandoned reservoir in an Illinois city, is well suited to the presentation of certain plays, as the stage occupies three different levels. It is built upon the sloping side of the old water basin and permits almost instantaneous change of scene since the curtains can be dropped on the setting at one level and raised for a continuation of the performance on the next, while in some performances no curtains would be needed. Artists were hired by the city, which owns the theater, to model it after those constructed by the ancient Greeks.

View of Open-Air Theater from Stage; Sloping Sides of Old Reservoir Simplified Construction of Tiers of Seats; There Is Room for 5,000 Spectators

Lieut. B. H. Wyatt, U. S. N., Who Will Command the Navy's Alaskan Expedition, Taking Apparatus Aboard One of His Planes Preparatory to a Trial Flight at the San Diego Air Base

Polar Expeditions and Navy Party, Outfitting to Photograph Alaska for Aerial Map, Mark Revived Interest in Arctic

WITH an American expedition planning to fly over the North Pole, starting at Alaska and ending in Spitzbergen; Amundsen planning to try again with a dirigible airship, and an American navy squadron preparing to map 40,000 square miles of Alaska's most inaccessible mountains from the air, the Far North again is in the limelight.

Two or three foreign explorers have prepared plans for airplane dashes into the Arctic, and may get under way before summer.

The race between Amundsen and the American party led by Capt. George H. Wilkins occupies the center of interest because both hope to fly across the vast unexplored area lying between Alaska and the pole, which the MacMillan expedition failed to reach last year. Somewhere in this million square miles of territory is believed to be an island continent, whose influence has been recorded on the ocean tides of northern Greenland. The one who gets there first, if he finds land, may claim it for his country.

The navy mapping expedition, while least spectacular, is fully as dangerous, if not more so, than the polar dashes, and at the same time will, if it succeeds, accomplish work of incalculable value. The government has been trying for many years to get an accurate map of the little-known parts of Alaska, but conditions are so unfavorable, the mountains and forests so vast and the territory so unsettled that only a small part has been done.

Forty picked officers and men from the navy air base at San Diego, equipped with four planes and a base ship, will attempt to make a complete aerial map of the 40,000 square miles lying between Ketchikan and the Aleutian islands. The district is one of the world's worst flying spots. The warm air over the Japan current, striking the glacial mountains, produces dense fogs throughout much of the summer, while the conflict of warm and cold air gives rise to a peculiarly violent air storm locally called the "willewaws," which wrecked one of the round-the-world flyers and delayed the others.

In this district are mountains rising three miles above the sea, deep and dark valleys, heavily wooded, an occasional small lake, and few, if any, spots where a plane may land on the ground. Three of the four photographic ships will be Loening amphibians, capable of landing either on water or land, giving the pilots a fair chance to glide to safety in event of engine trouble. The heavy amphibians, however, are sluggish in the upper air and lack the climbing ability to pass over

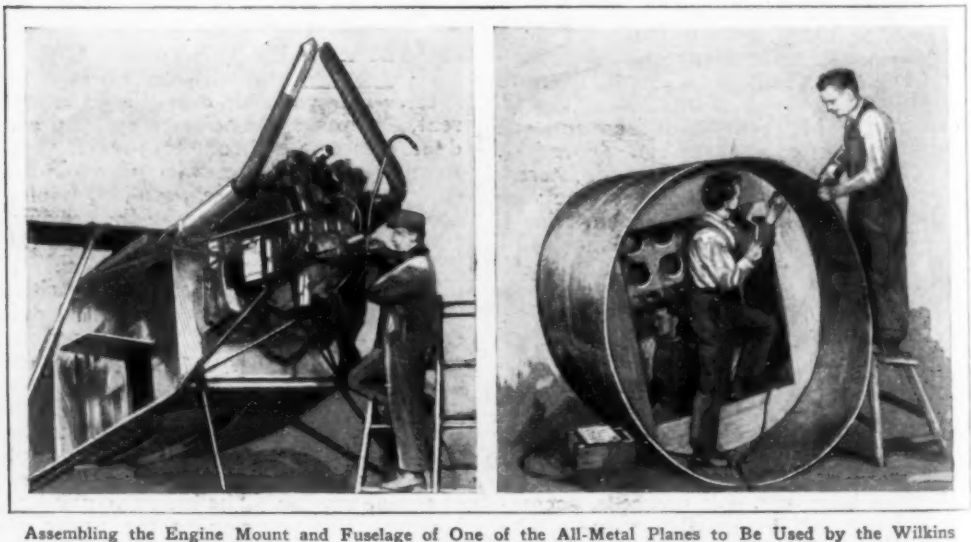
the highest mountain tops, so the fourth ship will be a small land machine, with interchangeable water pontoons. It has a "ceiling" of 18,000 feet, sufficient to fly over the 15,000-foot mountains at the proper height for taking the pictures needed for a mosaic map.

Under the direction of Lieut. B. H. Wyatt, who made the 25,000-mile flight around the United States and pioneered in aerial weather-observation work, the expedition has been quietly assembled at San Diego air base during the past several months. Three other lieutenants as flyers, a lieutenant commander as flight surgeon, and an enlisted personnel of thirty-five men, including pilots, mechanics, cooks, radiomen, carpenters, machinists and other repair and maintenance ratings with five expert aerial photographers, complete the party, while the mine layer "Gannet" has been assigned as base ship.

Leaving San Diego shortly after May 1, the planes will be flown to Alaska, with stops at San Francisco, Seattle, Vancouver and Prince Rupert. Bases will be established at Ketchikan, Hydaberg, Wrangell, Petersburg, Sitka, Juneau and Thane, and from them the vast territory, divided into strips, will be mapped. The flying altitude for the work will range from 4,000 to 18,000 feet.

The Wilkins polar expedition is already in the Far North, having left Seattle the latter part of January in order to get on the ground and be organized before summer opens. The best time for the flight is during April or early May. Two big Fokker all-metal planes, specially built for the work, were transported north in crates. One is equipped with three high-powered air-cooled motors and the other with a single big water-cooled Liberty engine. From the end of the government railroad at Nenana, where the planes will be uncrated and assembled, the party planned to fly to Point Barrow, the jumping-off spot on the shore of the Arctic ocean. Tons of supplies were forwarded by dog and motor sledges during the late winter and early spring so that the ships would not have to ferry their equipment to the main base.

Only one plane was to make the actual flight across the pole, the other being taken along for preliminary work, and to permit the explorers to make a last-minute choice between the air and water-cooled systems after trying them out under arctic conditions. Capt. Wilkins, who was second in command to Vilhjalmur Stefansson on his last arctic trip, is a qualified pilot, but the actual flying on most of the trip is to be done by Carl B. Eielson, a pilot who has blazed the air trails across Alaska for several years, leaving Wilkins free to do the navigating and make observations of the terrain passed over. Lieut. Eielson has flown more than 60,000 miles in the Arctic, at least three times the distance covered by any other pilot in the Far North, and it was for this reason that he was chosen by Wilkins. During his Alaskan flying he carried the mails regularly for the government, landing on the ice of frozen rivers and getting through on schedule despite temperatures far below zero.



Assembling the Engine Mount and Fuselage of One of the All-Metal Planes to Be Used by the Wilkins Expedition in the Attempt to Fly from Alaska across the North Pole

Unpacking the Machines and Assembling Them at San Diego for the Navy's Expedition to Map 40,000 Square Miles of Unknown Alaska with Aerial Mapping Cameras

Captain Stefansson, who took part in organizing the expedition, has high hopes that it will succeed. The coldest weather will be encountered between Fairbanks and Point Barrow, he says, while the actual polar dash, from the shore of Alaska to Spitzbergen, on the other side of the world, will have temperatures higher than Capt. Macready met on his altitude flights at Dayton. The chief danger, Stefansson says, is that the plane may be forced down on the last third of the air voyage, landing on the ice, which drifts south and melts in the warm Gulf stream. Should a landing be required at an earlier stage, Wilkins is confident that he and his companion can walk back to shore, armed with only a rifle, and live off the country on the way. His theories agree with those of Stefansson, but disagree with Amundsen's, who maintains that an arctic expedition should carry sufficient reserve food for a round trip. Stefansson has lived off the country by shooting seals and other game for months, and Wilkins, on the last trip, shared his experiences. By not carrying large reserve supplies of food the plane will be able to transport much more gasoline and oil than did Amundsen's ships on their unsuccessful trip last year.

TENT FOR CAMPERS HAS NO RIDGEPOLE

Held by self-adjusting levers and springs and two collapsible uprights at each end, a tent, especially suited to the auto tourist, requires no ridgepole, and, when not in use, folds into a small bag. Each of the end supports consists of telescoping sections of steel tubing, which fit within each other. The tent has a detachable floor which can be taken out for thorough cleanings and no tools are needed to erect the tent.

Tent's Spring Supports Serve as Ridgepole

Bombs Exhibited before House Military-Affairs Committee; Black Objects Are Bounding Bombs Which Can Be Exploded Several Feet from Ground

AIR TORPEDO CARRIES GASOLINE TO AID PLANE FLIGHT

Containing a supply of gasoline in addition to explosive, a bomb invented by an eastern man is intended to be attached to an airplane. It will hold sufficient gas for a journey of 1,000 miles, says the inventor. Besides this bomb, others which explode just before they reach the ground, and a special type of air depth bomb for use against submarines and other warships, were exhibited before the house military-affairs committee recently.

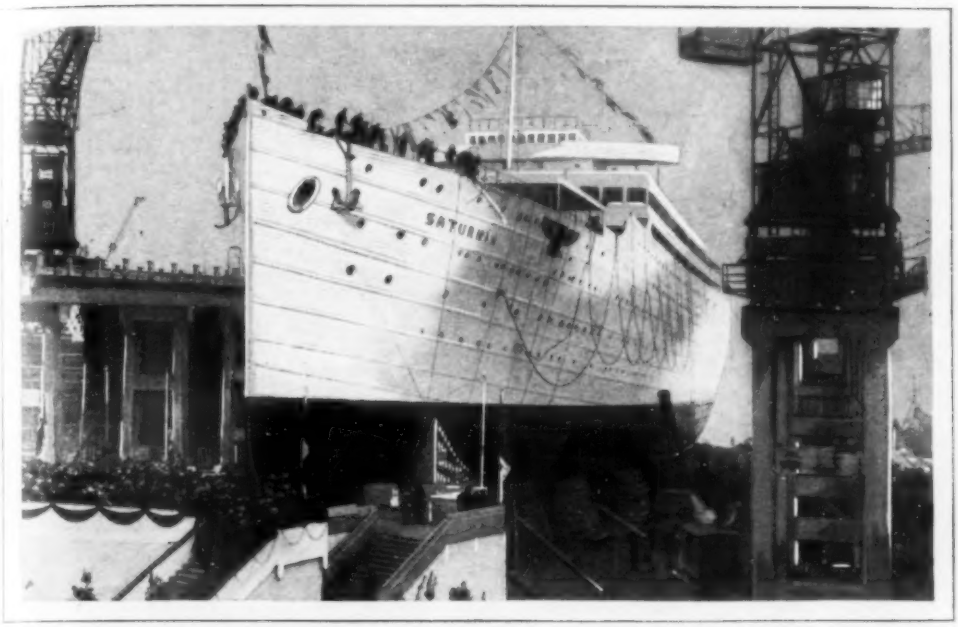
ULTRAVIOLET-RAY TREATMENT SIMPLIFIED BY PAPER

Beneficial baths of ultraviolet rays from sunlight may be had at greatly decreased cost, it is expected, as the result of a discovery of an eastern scientist. He has found that a type of transparent wrapping paper, commonly used on candy bars, permits the rays to pass through just as does the clear but much more expensive quartz. Ordinary glass filters the sunlight, robbing it of the peculiar rays that have been found helpful in treating children for rickets and for various other medical purposes. An eastern hospital has a large quartz window, but it cost $15,000, or $1,000 a pane, and it is this high cost of quartz that has prevented the wide use of the material. The paper is largely composed of cellulose, the substance that forms the cell walls of plants, gives stiffness to the wheat stalks and strength to the tall spruce. Until further tests have been made, the scientist is unwilling to state the degree of effectiveness that may be attained by the paper method. So far, the experiments have been largely limited to the winter months when the ultraviolet rays are weaker than in summer so that continued trials are considered necessary before definite conclusions can be drawn as to the value of the discovery.

DOG RUNS IN REVOLVING CAGE TO KEEP FIT FOR MOVIES

Keeping the animal actors in trim for motion-picture productions is one of the important tasks of moviedom. "Rin-Tin-Tin," the celebrated police-dog star, is given morning exercise in a huge revolving drum like a squirrel cage, to keep his muscles firm, his senses alert and his general condition good. In a short time, he can pace the equivalent of a considerable distance over ground; the trainer is spared labor, and the dog is protected from injuries that he might suffer if he were permitted to run around unleashed on motor-crowded streets for exercise.

"Rin-Tin-Tin," Movie Dog Hero Taking His Morning Exercise in Revolving Cage While Trainer Urges Him to Greater Speed



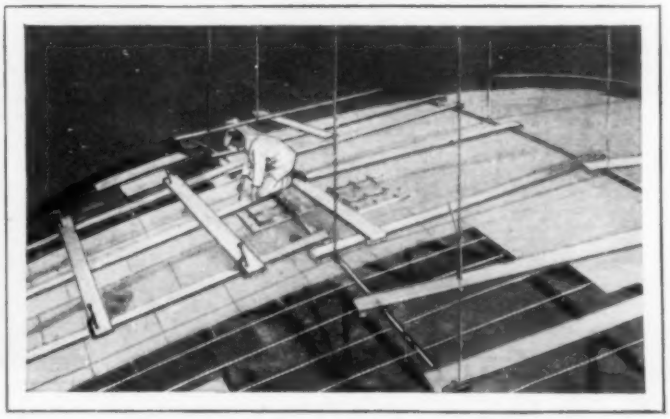
Scene at the Launching of the Huge Motor Vessel "Saturnia"; It Will Carry More Than 2,000 Persons besides a Crew of Several Hundred Men

LATEST MONSTER MOTOR SHIP BUILT IN TWENTY WEEKS

Completed in 140 working days, a record in shipbuilding, according to reports, the motor vessel "Saturnia" has a carrying capacity of 2,280 passengers, exclusive of the crew, besides 26,500 tons of cargo. This ship is 650 feet long, has an eighty-foot beam and displaces 35,000 tons. It can attain a speed of twenty-one knots.

BUILDING GIANT RELIEF MAP TO TAKE THREE YEARS

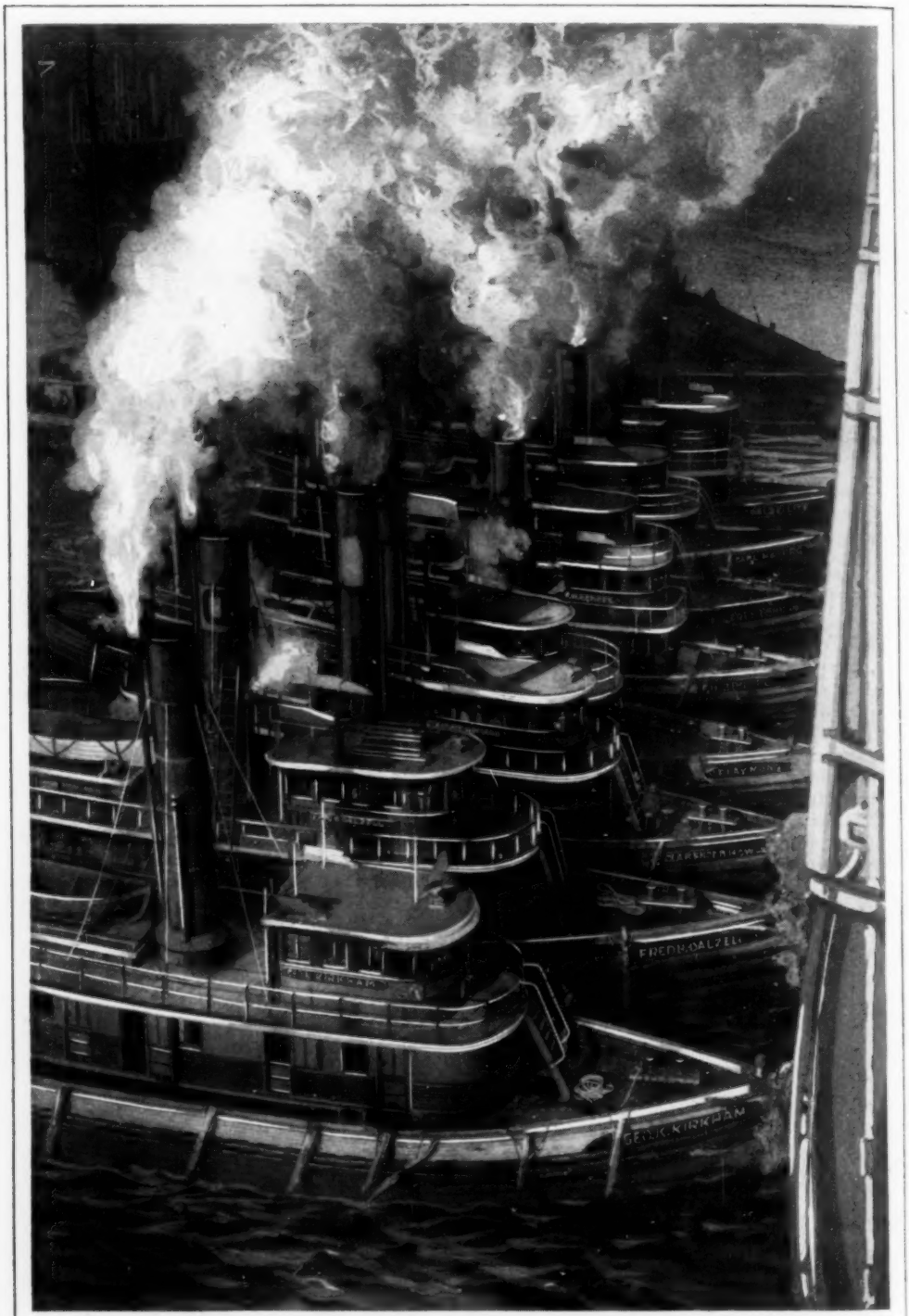
What will be one of the largest relief maps in the world is now under construction and is expected to be completed in three years. It will show details of the entire area of the United States and Canada. An iron-and-wood framework was first built, accurately curved to correspond to the actual shape of the earth, and upon this foundation the map itself is to be placed, in the form of a series of carefully molded and joined plaster plaques. To steady the base, supports have been attached to the roof of the work shop and connected to cross rods in the foundation which is also strongly braced.



Building Curved Foundation for Huge Relief Map

ARTIFICIAL FOGS GUARD CROPS FROM DAMAGE BY FROST

Artificial fogs, developed for military purposes by a Scandinavian scientist, are being put to peace-time use in Norway to protect crops from frost. The vapor forms a blanket over trees, vines and other growths, thus preventing freezing.



Eight Tugs, Side by Side, Fighting the Tide to Push a Huge Liner Around So That It Can Be Backed into the Slip in the Background; Many Big Ships Require Even More Tugs to Dock Them

With the Pilot and Tugboat Men

Chauffeuring Big Liners through New York Harbor and Boarding Them in Gales off Sandy Hook Require Skill and Daring

By FLOYD TAYLOR

A 900-FOOT liner left her pier in the North river not long ago, her nose was swung down stream by tugs and she was headed for the Ambrose channel. It was hazy weather, but clear enough so that the Jersey shore could be seen from the ship.

The pilot maneuvered to escape two "road-hog" ferryboats and two barges lashed to the sides of a tug. The haze grew thicker as the ship was eased down the river. Her nose poked past the tip of Manhattan island and slid into the upper harbor as a blanket of fog dropped down, so dense that those on the bridge couldn't see the bow.

"There's nothin' to call fog but a blanket of fog when it's like that," the pilot called to the captain.

"You don't have to tell me," the captain muttered. He was nervous. "You aren't going to take her down the channel in this, of course."

"You bet I'm not. I'm going to anchor her in the Statue of Liberty anchorage."

"This end of it is full of ships. I saw them this morning."

"I know it. There may be some in the lower end now. We've got to have good luck. If we don't, we'll cut somebody in two or go aground."

As the bells of the ships at anchor sounded from starboard, the pilot swung toward them a bit. He edged the monster over until he believed he was sending her exactly down the dividing line of the channel and anchorage. Steering by the compass, he sent his boat ahead slowly until he believed he had gone about 2,000 feet below the location of the last ship at anchor whose bell he had heard, and an anchor dropped from the bow. Hours later, when the fog had lifted, the captain and pilot, who had never left the bridge, found her in a good berth. So that one of the greatest liners could wait for safe weather, the pilot had executed a difficult maneuver through a fog so thick he could not see the ship's bow. He did it in a space hardly big enough for the ship to turn around, in a harbor which has as dense traffic as any in the world. His work cost the ship's owners about $200 but it may have saved them a million or more.

The Sandy Hook pilot is a craftsman of the highest rank, fighting with a minimum of loss against storm, tide, shoals and fog, and against the vagaries of the ships themselves. Fog is his worst enemy. Some of the pilots would rather take their chance with a howling gale than with an ordinary fog. They are not always successful in fighting fog, but their percentage of failure is amazingly small.

Off Sandy Hook; the Reserve Yawl of the Pilot's Association, Used When a Steamer Breaks Down

Tide and wind are jealous of the feats of fog in playing havoc in the harbor. In December, 1923, they sent the finest passenger ship of the United States on the sand bar of Robbins Reef. The "Leviathan," affectionately known as the "Levi" to many shipping men, was entering the upper bay. The wheel was swung to starboard and the ship didn't answer. It was swung hard over, engines were put at full speed reverse. Still she kept going straight for the reef. The tide and wind had caught her nose and were more powerful than her engines.

The boy who wants a Sandy Hook pilot's license is taken on as an apprentice for five years' work and study. If he can pass a severe examination at the end of that time, he is given a license to handle ships of eighteen-foot draft. He is a deputy pilot. Year by year, if he passes his examinations, his grade is increased until, thirteen years after he has entered the service, he can leap from a yawl off Sandy Hook for the end of a forty-foot rope ladder and climb it to bring in the "Leviathan" or "Majestic." His job of handling ships in the harbor is only half the job—the other half is that of the tugboat men.

The pilots share their expenses and earnings through a co-operative association. They work in rotation. There are about 100 pilots, and the number is limited to 130. A pilot usually makes between $300 and $350 a month. For piloting a ship of over twenty-one-foot draft from Sandy Hook the twenty miles or so to her pier, the charge is $4.88 for each foot of draft.

The pilot taking a ship down the harbor boards her by walking up the gangplank. From a pilot boat, it's a different matter. There always is a pilot boat off Sandy Hook; even in an eighty-mile gale the pilots are there waiting.

Last October a northeaster was blowing, kicking up a high sea. One of the 900-foot liners was coming in. Near the pilot boat she turned her beam to the wind, forming a lee. Down her side a rope ladder was dropped. The pilot boat crept up until she was about seventy-five feet from the liner's side. Two apprentices crawled into a yawl, after them a pilot, sixty-five years old, making one of the last trips before he retired.

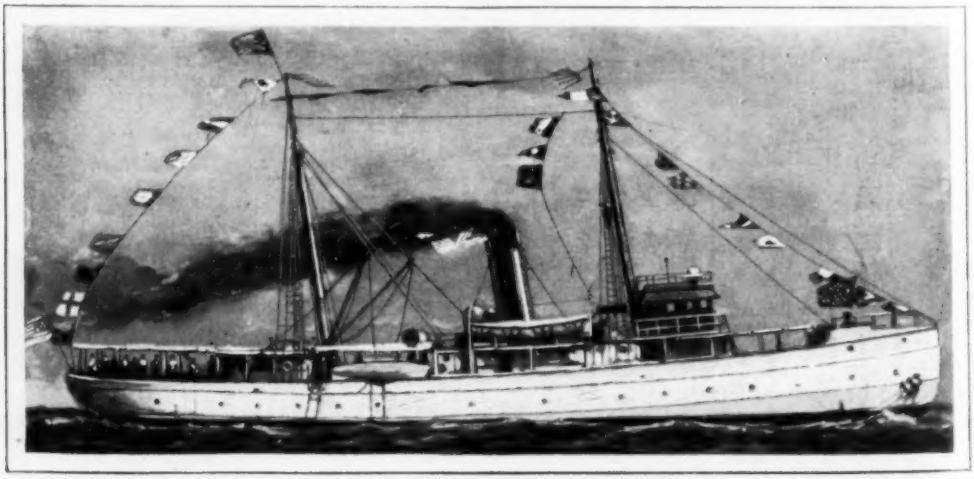
The yawl was dropped, the apprentices rowed desperately to get away from the pilot boat's side before a swell could crush them against it. Halfway to the steamer a wave flipped the yawl upside down. One of the apprentices managed to get on the keel and pull the other after him. The two pulled up the pilot.

Another yawl left the pilot boat, rescued the three and was rowed to the ship's side. The old pilot, waiting his chance, leaped for the ladder. The ship rolled back and he dipped into the water until his shoulders were covered. As the vessel rolled the other way, he clambered a few steps, was dipped twice again and finally reached the ship's rail.

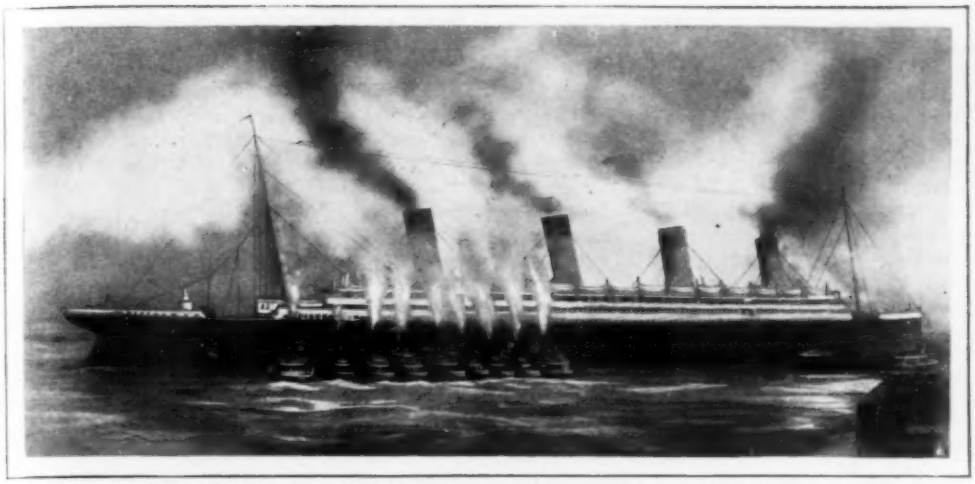
That day fifteen barges, torn from their moorings by the storm, were adrift in the upper harbor and the Narrows. The pilots had to work the ships through them to get to the docks.

Pilots bring in ships in all sorts of conditions. The "Arabic," battered by a storm, was brought through the Narrows with a ten-degree list last fall. A freighter, on fire for three days and so hot her crew's feet were burned walking on the deck, was raced through the Narrows by a Sandy Hook pilot and beached on the Red Hook flats.

One of the pilots' worst worries is the swell caused by the ships they handle. They must keep up a speed of thirteen or fourteen knots to handle a big ship, and a few knots more cause so much suction behind her that it swamps small craft and has been known to tear loose liners tied up at piers. One was torn



One of the Pilot Boats Which Cruise off the Harbor Mouth to Put Pilots Aboard Incoming Ships and Pick Up Those Dropped by Outgoing Vessels; the Pilots Own Their Own Boats



Swinging the Mighty "Olympic" of the White Star Line against the Tide, to Guide Her into the Slip; Tugboat Captains Must Have Both Skill and Plenty of Daring

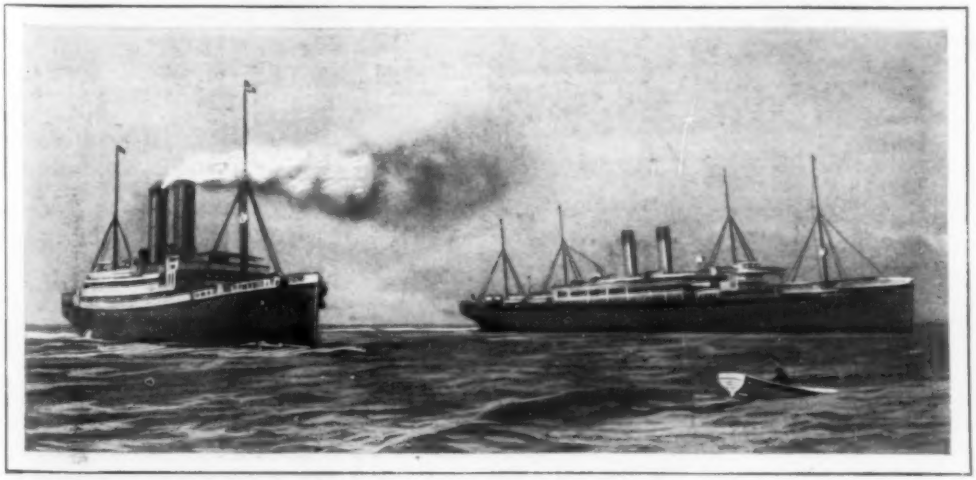
from her lines not long ago and slammed against the next pier, damaging both pier and ship. The Sandy Hook pilots handle about thirty ships a day. On Saturdays there are sometimes as many as sixty entering or leaving the harbor.

Damage is the curse of the tugboat business. "If we scratch off more than two inches of paint docking a liner in a gale against a strong flood tide," a tugboat captain said, "the company has to pay—and the next ten generations are given over to the official inquiry."

A tugboat man must be an apprentice for three years before he can get a license. There are about six tugboat companies in New York which have contracts for docking big liners. These do little general harbor work, almost nothing but docking.

About a dozen tugs is the quota for the biggest ships, but under severe weather conditions as many as twenty have been used on the "Leviathan" and "Majestic." Few landlubbers know that the gigantic liners must leave their docks in North river at full speed when the tide is running. They must, for once the stern of the ship is outside her pier, the tide swings her so fast she must be clear in a few seconds or tear away part of her dock or the next one.

If the tide is flood, the ship comes out at full speed with a half dozen tugs grimly holding her stern against the tide to keep it from swinging upstream too fast.



Picking Up the Pilots of Outbound Ships; the Pilot Vessel Has Dropped One Gig for the First Pilot and Will Go On and Drop a Second to Run in Alongside of the Other Steamer

The moment the bow is clear of the dock, the engines are started at full speed ahead to check momentum, otherwise the ship would ram the Jersey shore. Once the liner is in the river, the tugs straighten her out, the lines are dropped, and she goes down the harbor under her own power, in charge of the pilot. In bringing a ship to dock, the tugs take charge a few hundred feet from her pier. If the tide is coming in, her nose is headed into the pier opening, the tugs let the tide swing her until she is parallel with her pier and her own turbines slide her in. When the tide is flood, she is taken upstream, above the pier, and turned around before being docked.

The liner "Columbia" backed out of her dock one day at the foot of West Twenty-Fourth street and was headed down the river as the "Majestic" started from her pier near the foot of Eighteenth street. The pilot of the "Columbia" found a swirl of the tide was swinging his ship into the "Majestic." He had the wheel thrown hard to starboard and the engines speeded to give her steerage way. The tugs at the stern of the "Majestic" puffed, portentously at first and then rapidly. The "Columbia" missed the "Majestic," but hit a pier on the Jersey shore, ripping off a corner of it.

The "Mauretania" once was being pushed into her dock at Fourteenth street and seemed safely inside when the tide got the better of the tugboats and slammed her against the pier. The overhang of the navigation bridge struck a vertical girder supporting the roof of the pier. There was a report like a giant firecracker exploding. The captain of the "Mauretania" leaped a fraction of a second before a section of steel, ten feet long, from the pier structure was flung where he had stood.

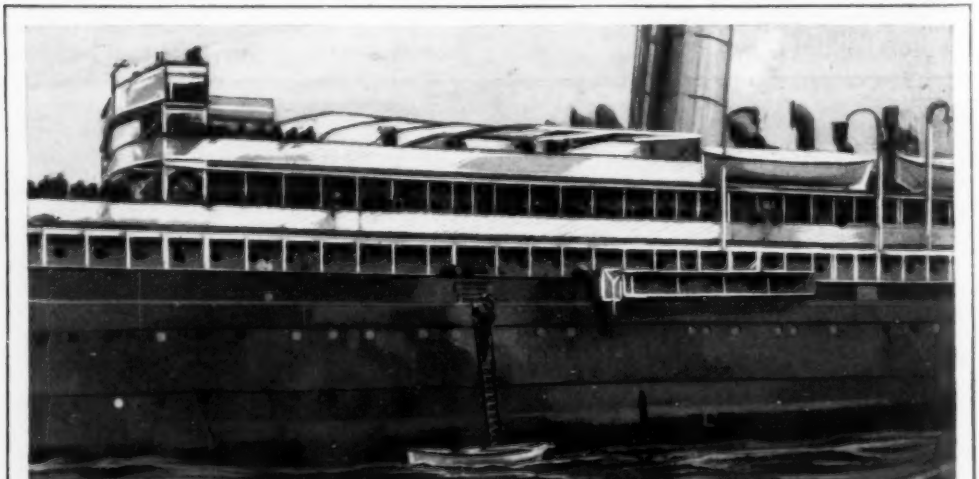
"That's a 'crack,' that is," the tugboat captain on the bridge said. "Crack" is the tugboat man's word for accident. But there are few such accidents, and there has never been a bad one.

On the rare occasions when a liner hits a pier with considerable momentum there isn't much pier left. It's hit with too many thousand tons. A tugboat captain, explaining that, said:

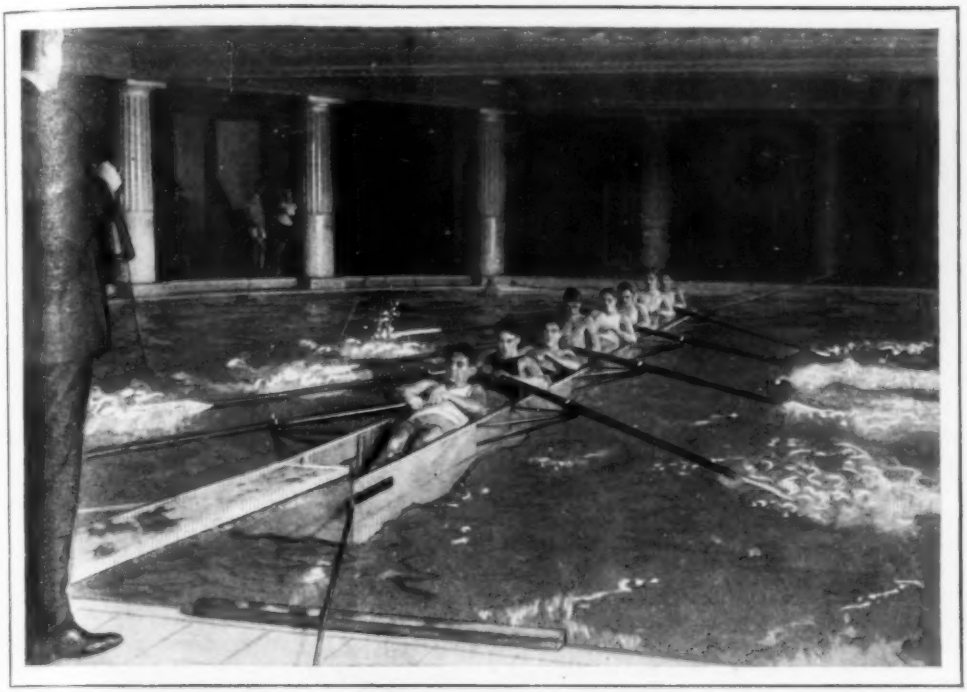
"There never was a really bad job done on docking any of those big ships. If there ever is a bad job, a real bad one, the 'Leviathan,' the 'Majestic' or the 'Berengaria' will cut Manhattan island right in two."

FOXES BEING RAISED FOR FUR PREFER FRESH-FRUIT DIET

Oranges and apples are the favorite food of foxes being raised at a fur farm near Los Angeles. The animals receive regular rations of bread and milk with an occasional treat of eggs and raw meat. The fruit is served as "dessert," and is bought in large quantities. Foxes that are destined for fur are fed a richer diet than the others, and they are killed in December when the pelts are at their best.



Boarding a Vessel off Sandy Hook in Calm Weather Is a Comparatively Easy Task, but, Calm or Rough, the Pilot Must Get Aboard, and If He Falls into the Sea, Another Takes His Place



Columbia University Oarsmen Use Gymnasium Swimming Pool for Early Crew Practice; Form and Teamwork Were the Objectives; Braces Kept the Hull from Bumping against Sides of Pool

CREW ROWS IN SWIMMING POOL TO PRACTICE FOR RACES

Candidates for the Columbia university crew enjoyed early practice for the racing season this year, even though ice prevented outdoor training. A special hull was constructed and tied to the sides of a gymnasium swimming pool. Oars were attached in regulation fashion, and the rowers, under the direction of coaches, received almost as much benefit from the daily drills with this equipment as would have been derived from shorter periods spent on the river. Since the hull was stationary and a close view of each oarsman was possible, the drill became more intensive, and errors in the stroke of any one of the men could easily be detected.

MEASLES SERUM FROM ADULTS AIDS CHILDREN

Prepared from the blood of adults who had measles in childhood, a serum that is said to modify the severity of the disease in children and to give them immunity for life, is reported from France. Its discovery was made during a shortage in the regular preparations, and more than 1,000 injections are said to have been given without any bad effects. The disease is reported to have caused more than 1,000,000 deaths in Europe between 1900 and 1910 and within the death-registration area of the United States, it claimed more than 100,000 victims from 1901 to 1920. Statistics from the more important countries show that the death rate from measles is falling more slowly than that from diphtheria, smallpox, scarlet fever and whooping cough.

SPRING HOLDER FOR PIPE STEM KEEPS BOWL UPRIGHT

Easily slipped upon the pipe stem, a spring bracket, with short legs at each side, keeps the bowl from tipping when the pipe is placed upon a table or other surface, and also protects the bit from breakage. It can be carried in the pocket when not in use or left on permanently, as it does not in any way interfere with the smoker.

¶A baseball bat can be completed in thirty seconds in a modern plant.

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Workmen Testing Strength of Life Net Stretched under Dome to Catch Anyone Who Might Fall from Scaffolding as Building Progressed

ROPE NET UNDER ROOF OF DOME PROTECTS WORKERS

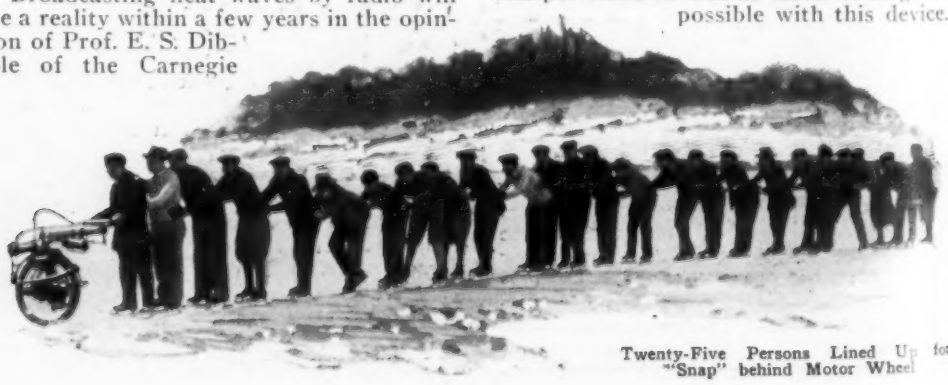
One of the safeguards used to protect workmen building a huge dome over a building in Berlin, Germany, was a net of rope stretched, spiderweb-fashion, where it would catch anyone who fell. The strands were woven closely enough to prevent a person from slipping through, but provided sufficient slack to break the force of a fall.

HOMES TO BE HEATED BY RADIO SCIENTIST PREDICTS

Broadcasting heat waves by radio will be a reality within a few years in the opinion of Prof. E. S. Dibble of the Carnegie Institute of technology. Having made a study of the problem as an expert in heating and ventilation, he is of the opinion that it is no more improbable to send heat waves in this manner than it was to broadcast sound waves, but that instruments must be discovered for properly controlling the waves, picking them up, holding and amplifying them. He visions large central plants from which heat will be sent direct to homes and office buildings. The system will largely eliminate pollution of the atmosphere by smoke, conserve fuel supplies and save labor, the professor points out. Like the radio, heat waves travel through space and through solids, and once man learns how to control them, heating throughout the world will be revolutionized, the scientist says.

"SNAP-THE-WHIP" WITH MOTOR LATEST WINTER SPORT

Skaters on a New York city pond enjoyed the ancient sport of "crack-the-whip" with a modern twist last winter, motive power being furnished by a single-cylinder one-wheeled motorcycle that whisked as many as thirty persons at a time in a speed chain over the smooth ice. A rough tire afforded the necessary traction and the cycle is said to have attained a speed of forty-five miles an hour. Sharper turns as well as faster sliding are possible with this device.



Twenty-Five Persons Lined Up for "Snap" behind Motor Wheel

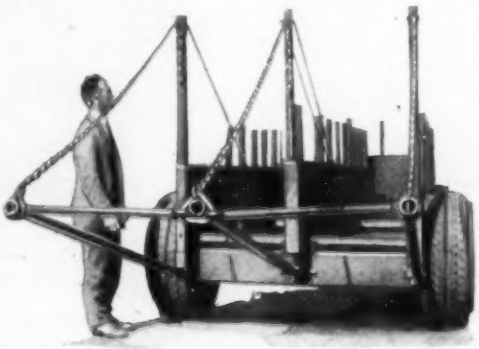
American Venice Is Doomed to Destruction, According to Reports; Canals Are to Be Filled for Roads

CANALS OF AMERICAN VENICE TO BE FILLED FOR STREETS

Since its annexation to Los Angeles, the suburb of Venice, Calif., is facing drastic changes. It is reported that the water highways of the town, modeled after the canals of its Italian namesake, are to be filled up and transformed into ordinary streets. Boating and swimming in the canals have been favorite pastimes, and the waterways have also served as scenic backgrounds for motion pictures.

EXTENSION ON TRUCK TRAILER HANDLES LONG PIECES

The capacity of an ordinary fifteen-foot truck trailer is practically doubled by the addition of removable extensions consisting of a series of chains, pipe supports and stanchions. Thirty-foot lengths can be hauled with this equipment, and when the pieces are to be unloaded, the chains are removed, allowing the units to drop down where they can easily be tied with a cable and dragged to the place desired, or dumped simply by running the tractor forward.



Detachable Extension of Pipes and Chains Permits Hauling of Long Pieces in Motor Truck

Rollers in the trailer bed help this action, allowing the load to slip out easily. Enough steel can be hauled in one trailer, with this addition, for the erection of two 100-foot towers for power purposes. A partition keeps pieces for each tower separate in the trailer.

INDIANS DIG FOR QUICKSILVER SIRES USED FOR PAINT

Stores of blood-red ore that lie under rugged mountains in southwestern Texas are still being sought by Indians, but not for war paint. The modern tribesman digs for the mercury which is extracted from the ore. For thirty years, the mines in this region have been worked, one company having produced $10,000,000 worth of quicksilver during the last quarter century. Indians and Mexicans inhabit the small mining villages, which remain as silent as tombs during the daytime while the men are working far below the surface of the earth. In one of the mines is a large cavern reached by a fifty-foot ladder, placed there years ago by the primitive tribes. Surrounding bluffs are decorated in Indian designs drawn in red pigment which is prepared from the ore.

CHAIR STILTS KEEP FEET DRY CROSSING FLOODED STREET

Rather than Dampen His Feet, This Citizen Used Chairs as Stilts to Cross Flooded Street

Supported on chairs which he lifted and replaced after each step, a resident of Liege, Belgium, kept his feet dry while crossing a flooded street and spared himself the risk of falling from ordinary stilts. Irregularities in the pavement added to the difficulty of the stunt, but since each chair had four legs the ingenious traveler met with no mishap.

SPIRAL PUMP LIFTS HEAVY OIL FOR BUILDING ROADS

One of the perplexing problems of the oil industry has been how to get the heavy, sticky grades, useful as ingredients in making roads, out of the ground. A western inventor has devised a pump which is reported to offer a solution and requires no heating in the hole. It is a spiral affair without valves and, with only a ten-horsepower engine, has been lifting a heavy grade of oil from a depth of 400 feet. Its capacity is from 300 to 400 barrels a day of this quality, but would be larger with lighter kinds. The spiral is continuous from top to bottom and has an inside shaft working in the opposite direction, operating a feeder which obtains the supply at the base of the well. The oil comes up mixed with sand, shale and other substances which are separated at a refinery. A small amount of gas and lubricating oil is also extracted, leaving a residue valuable in surfacing roads.

FARMYARD FOR FISH

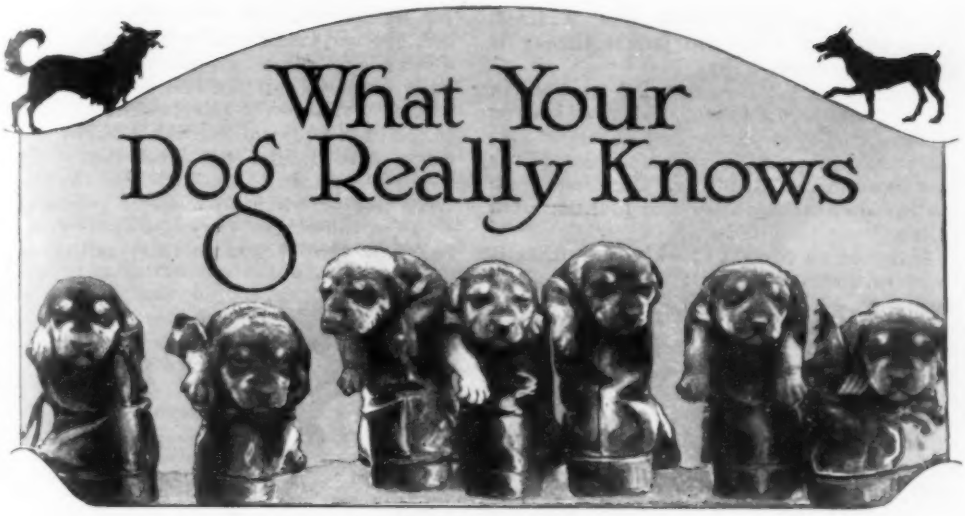
At Neilsen, on the Danish island of Zealand, an artificial lake, covering approximately 500 acres, has been formed for the raising of edible eels. Pumps have been installed to supply salt water to the fish, and a special passage has been arranged with fresh water flowing out to sea to attract the young eels, or "elvers" as they are called, to the submarine farm. The creatures are easily fed, grow rapidly and command good market prices. Raising them is an important industry in Germany. Before the war, more than 17,000,000 young fry were taken from Epney on the Severn in England to supply the German farms. About 1,000 are required to stock an acre, and they grow to marketable size in three to four years.

CROOK AND JACKET AID POLICE IN RESCUE OF FOG VICTIMS

London policemen traveling the dock districts have been equipped with crooks and special life-saving jackets to assist them in rescuing persons who fall into the water during dense fogs. A powerful pocket searchlight is also provided.

Ready to Rescue Fog Victims; London Policeman with Crook, Life Jacket and Flashlight

The crook is long enough to reach from a pier to the water or several feet below its surface and also helps the policeman find his way in the darkness.



What Your Dog Really Knows

By FRED C. KELLY

WHY does a dog wag his tail? A superficial answer would probably be: Because he's glad to see his master. But that is an answer that doesn't explain. The real question is: Why does he select tail wagging as a means of showing his pleasure?

Dogs first got into the habit of wagging their tails when on the chase. In the old days—even yet for that matter—the chase was the most fun they had. It meant the sport of matching wits with other animals, getting exhilarating exercise, and, best of all, hope of a good dinner in the end.

While many modern dogs still pursue game for the game itself, many more do so for the fun of the chase rather than for the game. This is shown in the fact that the most eager foxhounds often display not the slightest interest in the fox once it has been captured. At any rate, dogs early got tail wagging identified with something pleasant. This idea became so deeply implanted in their minds that now they wag their tails when joyful, no matter what about, whether it is the thought of chasing a rabbit or of seeing somebody they love. A dog has an equally natural reason for drooping his tail between his legs when scared. For hundreds of years his ancestors were pursued by all sorts of wild beasts and, as the tail was the first thing a pursuing animal might grab for, dogs thought it a good idea to tuck a tail as much out of reach as possible.

Nearly all dogs, I believe, draw their ears back when fighting or when feeling savage, and puppies, even in play, do this. Doubtless this habit grew out of the necessity to protect the ears from being torn in combat. Cats, when fighting, put back their ears in the same way; so do horses.

Most of the traits and abilities which now endear or make dogs valuable to mankind they acquired in their wild state and in their own way. People have not taught them nearly so much as they had already learned among themselves.

Grim Face of "Petrovia," Champion English Bulldog of the World, Who Has Won Fifty Silver Cups

Dogs get most of their traits from savage ancestors—wolves, jackals, and the like, and possibly from Australian dingoes. True, a few naturalists doubt that dogs are descended from wolves or jackals, but hold that their ancestors were of

a strictly canine species now extinct. However, the wolf and jackal theory is plausible enough.

In their wild state dogs had to work in packs, because the food problem was often serious, and they had to attack larger animals than it would have been possible for any one individually to kill if he had gone on his own hook, after the manner of a feline.

Many of us could probably take lessons from primitive dogs in recognizing the advantage of subordinating self for the common good. Dogs must have been smarter than certain other animals, even in the beginning, or else they wouldn't have had sense enough to see the gain in cooperation.

To work together effectively, those wild forebears of our own dogs had to have a system of signals. They didn't appoint a committee on signals and get these up all at once, but evolved them gradually as their needs demanded. Most important of these was their bark, to call the rest of the pack together. Whenever one caught a scent of game, a few loud barks brought other dogs who might be interested. Even though certain members of the pack were not on any too friendly terms with some of the others, they had sense enough to know that it was to their self-interest

"Rambling Gold," an English Coursing Hound Owned by a Louisiana Man, Has Made a World's Record High Jump of Twelve Feet Two Inches; He Is Also Reputed to Be the Fastest Dog in the United States, Having Won the Famous Futurity of the Southwest against a Field of 126 Dogs

to work in harmony and unity until the game had been overtaken and captured. After that, if they wished to stop co-operating and fight over the dividing up of the game it didn't matter much. Dogs of a pack agreed on the kind of bark that meant to get together and help. Even today any average dog has several kinds of barks for different occasions—probably more different kinds than his human associates realize. There is the bark of fear, of excitement, hatred, doubt, and joy. Being capable of nearly every human emotion—love, jealousy, hope, courage, timidity, and many more—he probably can give voice to every one. But few of us have our ears finely enough tuned always to distinguish one from another.

Possibly the dog acquired from his human associates the ability to express himself especially by the pitch of the voice. A man, when irritated or impatient, is inclined to speak in a high-pitched voice, and it is to be noted that dogs do the same thing.

Aside from many practical purposes, there may be another reason for a dog's bark. Lloyd Morgan, famous British student of animal intelligence, suggests that it is a means by which each indicates to the other the fact of his comforting presence. "The bleating of lambs at the hour of dusk, the lowing of contented cattle, the chirping of grasshoppers, the call notes of the migrating hosts of birds, all these, whatever else they may be, are the reassuring social links of sound, the grateful signs of friendly kindred presence."

But the bark wasn't the dog's only signal. There were times when a bark would have scared the game away before the whole pack could arrive on the trail. It was necessary, then, to have a silent signal. For this a dog's tail was a handy contrivance. I suppose that's what the tail was really made for—to wave information to other dogs approaching from the rear and aid in getting better co-operation. When close on the scent of game, a wise dog wags his tail as rapidly as possible. He doesn't give much thought to this—doesn't have to; he simply follows the instincts inherited from early kinsfolk. Hounds seem to make an especial point of this tail wagging when chasing something. As the scent of the trail grows more promising, they not only wag their tails but carry them as high as possible.

Eleven Ounces of Wire-Haired Japanese Pong, Claimed as the World's Smallest Dog

If a dog's tail happens to be white at the end, then the signal becomes all the more noticeable.

Why do farm dogs bring home the cows with so little teaching? Bringing cows home is much like hunting, except that there isn't any killing. Naturalists say that dogs used to circle about and round up the animals they intended to kill, and so it comes natural for certain breeds of dogs to work with cattle. It is not uncommon for dogs to be more capable of performing a task than of deciding when not to do it. A good watchdog is valuable not because he bites anybody who comes near, but because he acquires an astonishing degree of discretion and somehow knows which visitors not to bite. It isn't necessary to teach a dog to guard his home. He inherited that instinct. Indeed, it is one of the oldest instincts he has. When dogs lived in dens, they barked for self-protection when an intruder came near. Dogs that failed to do this risked being killed by their enemies. By process of natural se-

lection, nearly every dog became a watchdog. Those that did not readily bark signals of warning were sooner or later killed. However, even in the wild state, dogs learned to know that certain strangers were harmless. Tame wolves will guard a house but will let regular callers come and go without paying any attention to them.

The bark of a watchdog is for two purposes—to scare away anyone who doesn't belong, and to notify other dogs to come to his assistance. This latter is more traditional than useful, as most people do not keep more than one watchdog, and there aren't any other dogs on the same premises to come to aid. But because of their primal instincts, other dogs in the neighborhood answer the bark just the same, especially if it's in the middle of the night.

We humans are inclined to have a low opinion of men who are bluffers. With dogs it is a little different. Some of the most sensible dogs do a lot of bluffing. A big bark not seldom saves a bite or bloodshed.

If it is useful for a dog to impress another dog with his ferocity, it is equally useful to show a dog when he is friendly. A courageous dog will keep on fighting as long as there is an ounce of strength in him. But even a good fighter often realizes that discretion is the better part of valor. When a dog much bigger than himself walks up to him in a threatening manner, he is likely to roll over on his back in an attitude of complete submission, knowing that a dog has enough sense of decency not to bite another dog when he thus gives up. A big dog will seldom bite a smaller dog unless the little dog bites him first. But little dogs often take advantage of this immunity and run up to big dogs, barking as if bent on murder. This seems to be merely a form of showing off. A little dog evidently likes to have the neighbors see how brave he is when danger is more apparent than real.

Nearly everybody must have noticed that a dog ordinarily lowers his head when he growls, but holds his head high when barking. A growl means a possible fight, and a dog instinctively lowers his head to guard his throat. But a bark doesn't necessarily bode ill and a dog's vocal cords work better when he raises his head. It is almost impossible for a dog to bark well when lying on his back. I taught one dog to bark for a piece of meat and also to play dead on command. Then I tried to combine these two accomplishments. The dog tried to bark while on his back, but he had such difficulty that his efforts were laughable.

The disposition to growl at any other dog near the food supply is one of the most deep-seated of dog traits, because, at one time, if a dog let himself be too easily imposed on and lost his share of victuals, it was a question of life or death.

The Dogs of Belgium and Holland Are Taught to Work; Here Is a Milkman on His Rounds

In many respects dogs exhibit better

The St. Bernard Is Rapidly Becoming Extinct, Being Too Big for Modern City Life; Here Is a Picture of Five Champions at One of the Few American Kennels Still Raising Them

judgment than we do—particularly about eating. A dog never eats just because it is meal time. He eats only when hungry. If he doesn't feel just right, he lets food alone, no matter how tempting it looks. Moreover, when he is hungry and an assortment of food is placed before him, he picks out the thing he likes best and eats it first, instead of saving it for dessert after he's all filled up with other things.

People often laugh at dogs and say they have food on their minds all the time. This is true, in a way, because dogs have a limited number of pleasures and little opportunity for intellectual enjoyment. Food is less important to us because we can always manage to obtain food when we need it. With dogs, food isn't always so sure. Away back yonder in the earlier days of the species, they usually had to risk their lives for food before they got it. No wonder food seems to them so important.

We sometimes deplore a dog's habit of bolting his food—swallowing a large chunk of meat at one gulp. Luckily his stomach is built to digest food eaten thus hastily. It had to be so in his wild state, that he might eat hurriedly while pursued by his enemies. Moreover, if the pack brought down a large animal and an overpolite dog waited to chew each bite before swallowing, the others might greedily eat his share as well as their own.

Because of human vanity, one of the things most sought in a dog is the so-called "one-man" quality. It flatters the master to have even a dog show a marked preference for his society. A dog does this readily enough because of his old instinct to follow the leader of the pack. Why not, people ask, one-woman dogs as well as one-man dogs? There are. A dog will follow a woman as readily as he would a man, provided she is really the leader of the household. It is hard to fool dogs about who is the boss. In the long run, dogs seem more likely to take up with men because men do more of the things that dogs enjoy doing, such as hunting and going on long hikes.

It is possible to exaggerate the sense of loyalty to his master a dog has. So opposed is the dog to being left alone, and so disposed by hereditary instincts to follow a leader, that he readily adopts a master and gives him whole-hearted devotion; but, nevertheless, it is not difficult for a dog to take up with a new master. After a week or two, he may be just as loyal to the new one as he was to his previous owner.

Everybody who has a dog has noticed him turning around two or three times before lying down—exactly as he would do if making a bed for himself in tall grass that must be flattened out before it can be comfortable. A dog is fussy about his bed. If compelled to lie on bare ground, he may scoop out enough earth with his paws to make a hollow somewhat corresponding to the shape of his body.

It is barely possible, as one naturalist suggests, that another reason why this habit of turning around has survived so long, is that the practice had so-called elimination value; that is to say, in the wild state those dogs that did not do so failed to escape the attention of their enemies, or possibly of snakes hidden in the grass, and perished. This idea, though, seems far-fetched. It is more likely that the practice is merely a habit based on the need of mashing down the grass for a comfortable bed.

Most people understand, that a dog pants, not because he is out of breath, but because he is warm and the sweat glands are in his tongue.

Why does a dog bark at the moon?

Possibly because in ancient days he used to hunt by moonlight and set up a signal to call other dogs to join him.

You may have observed your dog cocking his head to one side when hearing strange sounds. This habit—especially noticeable in puppies—seems to be due to the fact that during many generations dogs have found it necessary to prick up their ears and put them at the most advantageous angle to catch sounds of

Another Working Dog of Belgium Who Trots in This Treadmill to Furnish the Power Which Daily Churns the Butter and Operates Other Household Appliances

Director of a Clever Series of Animal Comedies Surrounded by His Actors; Painstaking Care and the Affection of the Animals Are the Main Requisites in Producing These Movies

danger. When trying to see an object, naturally dogs also try to hear it. Thus has grown up a relation between their eyes and ears with the result that dogs usually prick up their ears when looking intensely at an object. Not only that, but a dog is quite likely to raise his nose and sniff on hearing a strange sound. Nearly every dog owner, I suppose, has amused himself by making a queer sound with his mouth to cause his dog to turn his head to one side and then sniff. Since the dog lives in a world of smell, the moment he hears a strange sound he tries to use his nose as well as his ears because he has found his nose is more dependable.

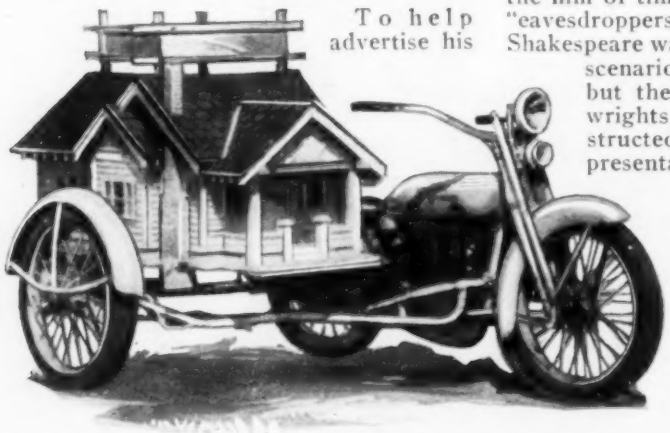
LANTERN SLIDES AS TEXTBOOKS ADD INTEREST TO LESSONS

Grade pupils attending a Wisconsin school enjoy the pleasures of a picture show while learning to read and "do sums," for their teacher uses lantern slides as a substitute for classroom textbooks. The method is said to increase the pupils' interest, speeds their progress and, according to the superintendent, can be adapted to work in the upper grades and high schools. First reading lessons consist in practice with the names of the parts of animals, which are written upon a slide with a picture of the creature studied. The pupils are taught to associate the word with the illustration and soon learn to recognize the names without the slide. Arithmetic problems are worked from pictures of a grocery window display in which the various articles for sale carry price tags. The pupil is asked, for instance, how many things he can buy for a dollar, and similar exercises are given in subtraction, multiplication and division.

GOGGLES WITH WATER POCKETS CLEANED BY NODDING HEAD

Rubber goggles, intended especially for laboratory workers to protect the eyes from dangerous dust or fumes, have pockets between the lenses in which a small quantity of water is placed to keep the glass clear. A nod or shake of the head bathes the surfaces and the water falls back into the cups below where it cannot interfere with vision. This eliminates the necessity of removing the goggles to clean them, a step which might be attended with danger in performing certain experiments.

MODEL STORE ON MOTORCYCLE CARRIES CANDY ORDERS



Little Candy Store on Wheels; Model Is Reproduction of the Real Building and Holds Packages for Delivery

To help advertise his wares, a western candy merchant has constructed a model reproduction of his bungalow store as the sidecar of the motorcycle with which delivery of orders is made. The arrangement not only attracts attention, but protects the goods within.

TRICKS IN ART OF RADIO DRAMA GIVE EFFECTIVE RESULTS

Breaking toothpicks sound like crashing forest trees; an insect's buzzing passes for the roar of a wild animal, and breathing into a lamp chimney conveys the impression of a terrific windstorm to listeners miles away, while a mop swished around in a pail is heard as a hurricane raging at sea. These are a few of the devices that the producers of radio dramas have developed as aids to the ether plays. This form of presentation is regarded as a new art, as distinctive as the motion picture and as different from ordinary stage work as the film story is from the printed page.

One producer declares that the radio play is a "series of sound pictures printed on the film of time." Patrons he regards as "eavesdroppers listening in on real life." Shakespeare was a natural writer of "radio scenarios," this authority believes, but the work of almost all playwrights must be completely reconstructed before it is suitable for presentation over the microphone. For that reason, the development of a special radio playwright is urged. One of the tasks is to harmonize the three kinds of sounds which are the chief ingredients of the radio drama: music, speech and accessory noises. It has been found that about thirty-five minutes is as long as the attention of the listener can be held by a radio play, so that skill is required in condensing works that require thrice as much time for ordinary stage production. Another problem is to determine what instrument to use to imitate sounds to get the best reception. Attention is also given to the pause, which is as effective in radio as in the visible stage drama.

Drawing Band over Package from Holder

RUBBER-BAND PACKAGE TIER SAVES TIME

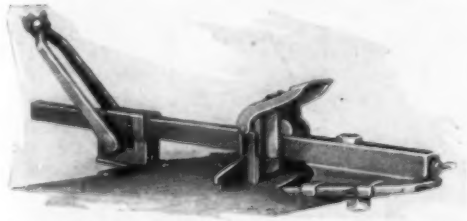
For stores, offices or homes, a triangular holder, with a supply of rubber bands at the base, permits tying packages of various sizes in a few seconds; does away with the bother of string and keeps the bands where they are not likely to get lost. The bundle is simply placed on top of the holder with the left hand and a band drawn over it with the right. About 900 rubbers make a pound in the size recommended for package use, and they may be cut at the rate of 20,000 an hour from tubes in a power outfit.

RECORD SOUND OF QUAKE TO GIVE WARNING

By means of a sensitive electric apparatus a Japanese scientist has developed, approaching earthquakes are said to be translated into sound several seconds before the actual shock. With this equipment, the inventor declares, it would be possible to send the warning by wireless to distant parts of the world so that knowledge of the quake would be imparted although its tremors would be too faint to register upon seismographs. The outfit consists principally of a pendulum, an electric coil and an amplifier. The pendulum is so delicately hung that it reacts to the slightest horizontal or vertical motion. When it is set in motion, it affects the rest of the apparatus in such a way that a warning sound is produced through the electric coil and amplified by the loud-speaker arrangement. Tests showed that such slight vibrations as were caused by tapping on a table or walking across the room, actuated the mechanism. A great benefit seen in the invention is that it might aid scientists in predicting quakes by informing them of others near or far away, so that warnings could be issued in time.

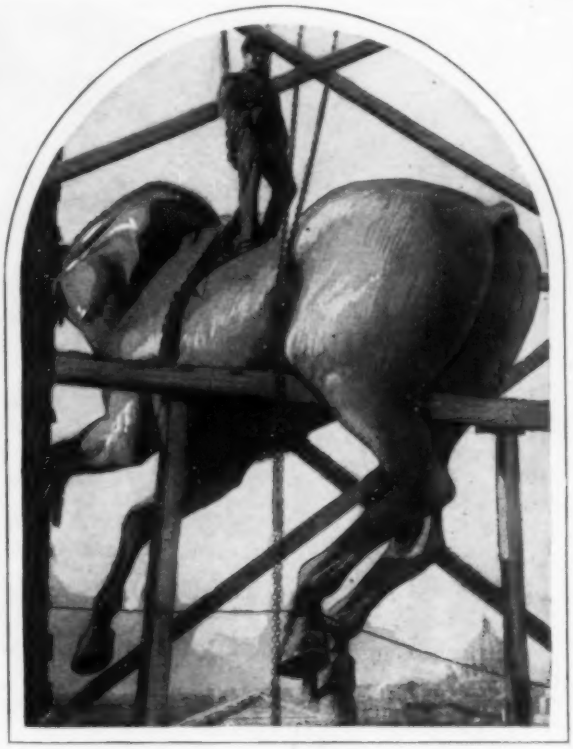
LEVER MORTISER FOR HINGES SAVES CARPENTER'S TIME

Hinges for cupboards, windows or doors can be mortised in, without tracing or using a butt gauge, in not more than a minute each, it is said, by using an adjustable tool now on the market. It is fixed to cut in almost any kind of wood, can be accurately set for width and



Tool in Place for Cutting Out Mortise for Hinge; Blade Is Adjustable to Different Depths

depth, and since it makes exactly the same size cut for each hinge, it prevents the doors from binding when they are hung.



Courtesy The Graphic

Hoisting One of the Huge Stone Horses to Its Position on the Palace of Justice in Rome

RAISING OF HUGE STONE HORSE TESTS ENGINEERS' SKILL

With modern hoisting equipment, ponderous steel beams, heavy safes and other large objects are raised with comparative ease, but in placing the huge stone horses on the Palace of Justice in Rome, several unusual difficulties were encountered. To protect the sculptures from damage, chains were tied about the horses' feet so that the statues could be swung away from the walls and prevent breakage. The irregular shape of the load made it hard to balance, and the placing had to be done around and through a network of specially designed scaffolding.

CITY TRAFFIC-SIGNAL BELLS REPLACE ALARM CLOCKS

Lodgers at hotels in the downtown section of a Texas city report that they have no further use for alarm clocks, for they are awakened at seven o'clock by the clang of traffic-bell signals on the streets outside. Their clamor is sufficiently loud to rouse sleepers in several of the smaller hotels near street intersections.

Flying Cargoes

© P. & A.

Birds and Elephants, Tigers and Snakes, Picture Films and Grand Pianos, All Kinds of Merchandise Come to Aerial-Freight Man

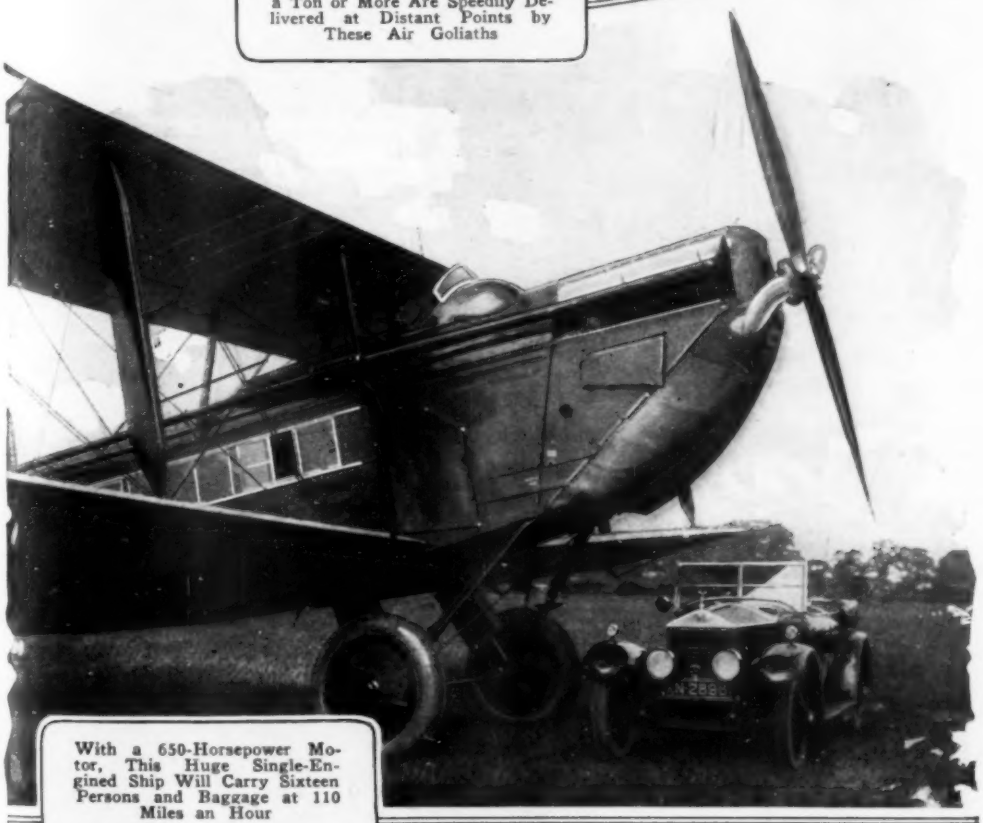
By CY CALDWELL

A LARGE circus advertised as a star attraction the "Missing Link," a chimpanzee who could smoke, dance, drink, roller-skate and eat at a table. When city and countryside have been billed with pictures of this creature, nothing must prevent his making an appearance, both afternoon and evening. In this modern age of speed not even death itself can interfere with a performance. As witness the case of "Bongo," the chimpanzee who died while the circus train was en route to Toledo.

The mere fact that "Bongo" was gone was no reason why Toledo audiences should be deprived of seeing him alive and in good health, however, for in New York city there was a man who trained chimpanzees and had one on hand at the time. He was communicated with by telephone; a pilot and airplane were hired in New York, and within two hours the animal was speeding westward at some ninety miles an hour. And when the show went on, there was "Bongo" at his little table having afternoon tea, with none of the spectators any the wiser.

"Bongo" was just one of the many strange cargoes that have been carried in airplanes. Snakes, lions, tigers, dogs, cats, bears, kangaroos, and even elephants, have been transported by air. Sometimes the animals were urgently required for a circus or show; at others, they were carried in connection with some advertising stunt. I may not be credited with a love of truth when I state that an elephant has been taken for a flight. But if I am not believed at once, it is only because the word "elephant" immediately presents to the reader the mental picture of a massive creature weighing tons. It must be remembered that every big elephant was a little elephant once. Catch him young and he is quite eligible as a passenger—provided he is in a crate or is securely roped. A small elephant has been carried in an airplane as an advertising stunt, and in quite a small plane at that. Such a plane as the big Barling

The Big Double-Motored Sikorsky Plane in Which Two Baby-Grand Pianos Were Transported from New York to Washington; Articles Weighing a Ton or More Are Speedily Delivered at Distant Points by These Air Goliaths



With a 650-Horsepower Motor, This Huge Single-Engined Ship Will Carry Sixteen Persons and Baggage at 110 Miles an Hour

bomber could carry a grown elephant. This plane has climbed to a height of nearly a mile, carrying a load of 8,818 pounds, or nearly four and a half tons.

Dogs and cats are frequent aerial passengers. "Ike," a cat owned by the air-mail pilots at Cleveland, crawled into the tail of a mail plane and flew to Bellefonte. Dogs especially seem as fond of travel in planes as they are in automobiles. During the war, an English ferry pilot—one who delivers planes from the depots to the service squadrons—had a fox terrier who was a constant aviator. He would ride on his owner's lap every trip, and would bark and show extreme disappointment if he was made to stay behind. During flight he would place his fore paws on the side of the cockpit, and apparently take a keen interest in the scenery as it passed below him.

Later, when the British government placed an embargo on all dogs coming from France on account of an epidemic of rabies, English pilots ferrying old planes back from France for use in training squadrons in England, were in the habit of bringing a dog or two nearly every trip. There was considerable demand for Belgian police dogs at the time, so the pilots augmented their slender war wages by entering the dog business, embargo or no. It might be just whispered in passing that many cases of expensive French wines flew calmly over the customhouse at Folkestone, and landed farther inland.

In Belgium, racing pigeons are transported by air in a specially designed plane, not for advertising but merely because it is more comfortable and less tiring for the birds. A flock of racing pigeons sent in hampers 500 miles from their home by train arrive tired and dispirited. They have spent at least a day and a night, sometimes more, in a hamper stowed in a baggage van; perhaps they have had several changes of trains, necessitating the disturbance and fright of being handled and thrown around.

Lashed over the Front Cockpit, This Talking Machine Was Rushed to a Distant Dealer

© Photopress

Twenty Passengers Were Served a Complete Lunch in This Big Vickers Passenger Liner

In a plane, on the other hand, they are put in their little compartments, have fresh air and light all the journey, which takes only five hours instead of perhaps thirty, and arrive in perfect condition for their return flight on their own power.

Nearly everything in the world, not excluded by bulk or weight, has been flown somewhere by someone. Animals, birds, ladies' dresses, pictures, motor cars, parts of machinery, fire-fighting pumps and hose, pianos, phonographs, cameras, drugs, serums, whisky and contraband Chinamen, are some of these.

The Canadian government forest-patrol planes carry as standard equipment a gasoline-driven fire-fighting pump, and several hundred feet of hose. They are equipped like a harbor fireboat, though on a small scale, and can put out any small forest fire in the early stages. In addition they carry, according to their size, from three to ten fire rangers.

A frequent cargo in this country is pictures and news reels of important events, for the transport of which the photo syndicates are willing to pay fancy prices—from fifty to seventy-five cents a mile each way the round trip, according to the type of plane used. The Dempsey-Carpentier fight, the republican and democratic conventions, the Tennessee evolution trial, the world series, the "Shenandoah" disaster and the Santa Barbara earthquake are a few of the events of which airplanes have carried pictures.

The nice thing about pictures, from the pilot's viewpoint, is that they weigh little and take up no room. The worst thing to carry is something too large to go inside the airplane. Recently I carried a big cabinet-sized phonograph from Philadelphia to Cleveland, tied across the fuselage, or body, of an ordinary small plane. It stuck out a foot on either side and shut out all view forward. This is called "flying blind," and is not advisable.

In large planes this difficulty does not occur, for the baggage compartment is sufficiently roomy to carry the goods inside, where they should be carried, not out in front of the pilot or tied to a wing. A disassembled Ford roadster has been shipped from Detroit to Cleveland; and an Essex coach, assembled and ready to

run, has been flown in the Remington-Burnelli air liner, with plenty of room for passengers besides. The twin-motored Sikorsky plane recently carried two grand pianos, together, from New York to Washington. The Ford planes make daily flights from Detroit to Chicago and Cleveland with parts, half a ton each trip.

In advertising flights, the passenger carried is usually a reporter who writes his impressions after he gets back to the office. As a rule he sleeps through the flight and sees nothing, wherefore it is delightful to the pilot to read "the majestic Susquehanna lay beneath us," when he knows very well the reporter never saw it, unless in a dream. News-reel photographers and cameramen are frequent passengers on advertising flights, as are the commercial mapping and photograph men, to whom a flight is just part of the day's work. It is the passenger who has never before been up, but who wants all the stunts, who causes amusement to pilots.

I once carried a real-estate man who decided to open his new subdivision by looping over it and dropping a key from the air. This key was a massive wooden one, about four feet long, and gilded —"a golden key from the clouds," he called it in his ad. Whoever reached the key first, when it fell, was to get a lot. We started off, the little man clutching his big key. In one of the loops he let it go, to hang on. It blew back, struck me a glancing but painful blow on the head, and disappeared. "Well," I thought, "the subdivision is open anyhow." But when we landed at our home field, there was the key wedged firmly in the tail-unit bracing.

Lately much publicity has been given supposed cures of deafness by diving in airplanes. Probably some of the sufferers imagined they were helped; perhaps some even were. However, I have never met anyone who claims to have derived any benefit from diving in an airplane, though I have read of them in newspapers. In one case, it is true, the patient never complained again of deafness—the plane, a very old one, broke up in the dive! All the shocks of air travel do not come to the pilot. Sometimes the passenger gets a decided thrill, as did Richard Barthelmess, the movie actor, last spring. The plane in which he had flown as a passenger from Virginia landed at Bolling Field, Washington, and stopped in the middle of the aerodrome. Barthelmess looked back to see why his pilot did not taxi into the hangar. The pilot was sitting slumped down in his seat. He had died of heart failure!

Hardly a day passes but some new cargo is brought to an aviation field for delivery a few hundred miles away at a hundred miles an hour. It may be a congressman rushing to keep a speaking engagement, repair parts for a broken machine, an animal for a circus, or, as in Alaska last year, a cargo of precious serum needed to save the children of a stricken town. In Europe they transport gold by airplane to foil bandits.

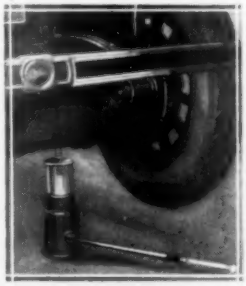
The Author and a Friend Pose for a "Smuggler" Picture

POLICE DOG FAILS AS DETECTIVE TESTS IN GERMANY SHOW

Has the value of the police dog as a detective for trailing suspects and finding missing persons and objects been overestimated? Reports of tests conducted in Germany indicate that it has, although opinion is divided in that country and the dogs have stanch defenders. The question arose with the publication of conclusions reached by Maj. Most, former manager of a large training school for the dogs. He declared that they could not be trained so that they would generally recognize the scent of a strange person after having smelled of the person or his belongings, and that it was almost impossible for them to pick up a cold scent. These statements were challenged by a police inspector. A test was promptly arranged to determine the point. In the presence of numerous officials, six dogs in the active police service, after twenty-seven trials, succeeded only twice in the tests, which consisted in picking up a cold scent, recognizing a fresh one, finding an article by the scent of its owner, and tracking down a man and finding him after having smelled his belongings. They found only one article and one man. Later, sixteen dogs went through the tests but with no better results.

JACK RAISES AUTO BY GAS AT TURN OF WRIST

Kneeling, with the attendant likelihood of soiling the clothing, and having to manipulate a ratchet or lever are eliminated in an automobile jack that lifts cars by the expansion of a tube of compressed gas released within a cylinder. The gas container is placed in the end of the jack handle. A turn of the wrist, on a grip, pierces the bulb that contains the vapor, allowing it to pass to the cylinder fitted within an air-tight jacket. Tubes enough for a year's use are contained in a magazine under the removable top of the cylinder, and there is a threaded top which is screwed upward to fit snugly under the car before applying the gas. By turning another grip on the handle, the jack is lowered. It can be stopped at any moment.



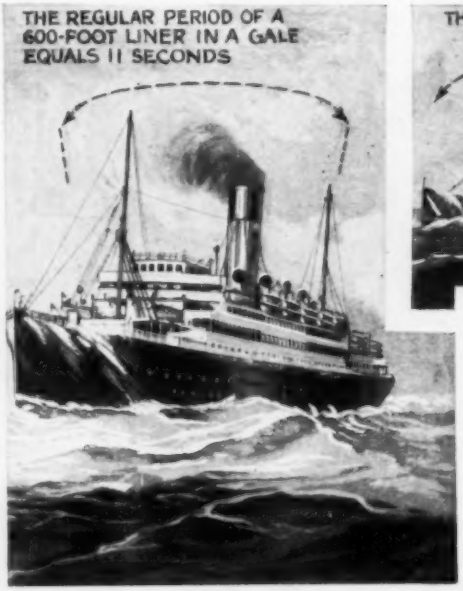
Ready for an Ascent in Jumping Balloon; Propeller Is Attached Just below the Support Cords

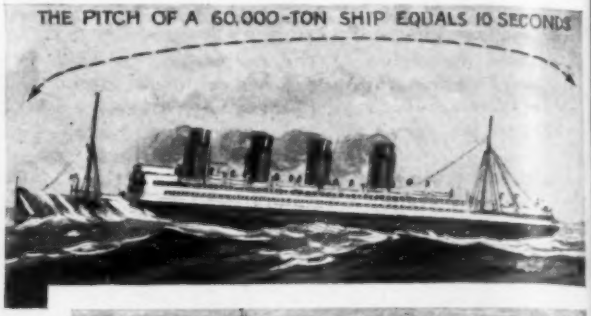
JUMPING PROPELLER BALLOON HELPS TRAIN AVIATORS

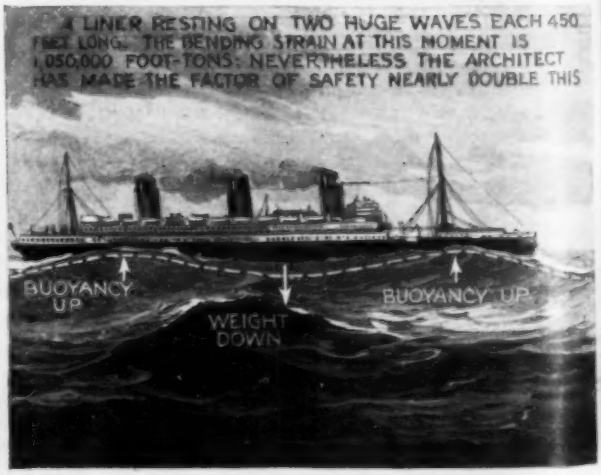
Equipped with a propeller, a jumping balloon devised by two Ohio airmen, permits a single passenger to rise quickly to various altitudes from a few hundred to several thousand feet for taking pictures, learning to control and guide the craft and making parachute landings. The balloon is slightly elongated, offering less resistance to the air, and because it can rise so quickly, it is adapted to jumping over buildings, trees and other obstacles. By changing the position of the propeller blades and the direction of their rotation, the height to which the balloon ascends can be governed.

¶In one year, a sea urchin lays as many eggs as there are inhabitants in New York city, it is estimated.

How Giant Ocean Liners Defeat



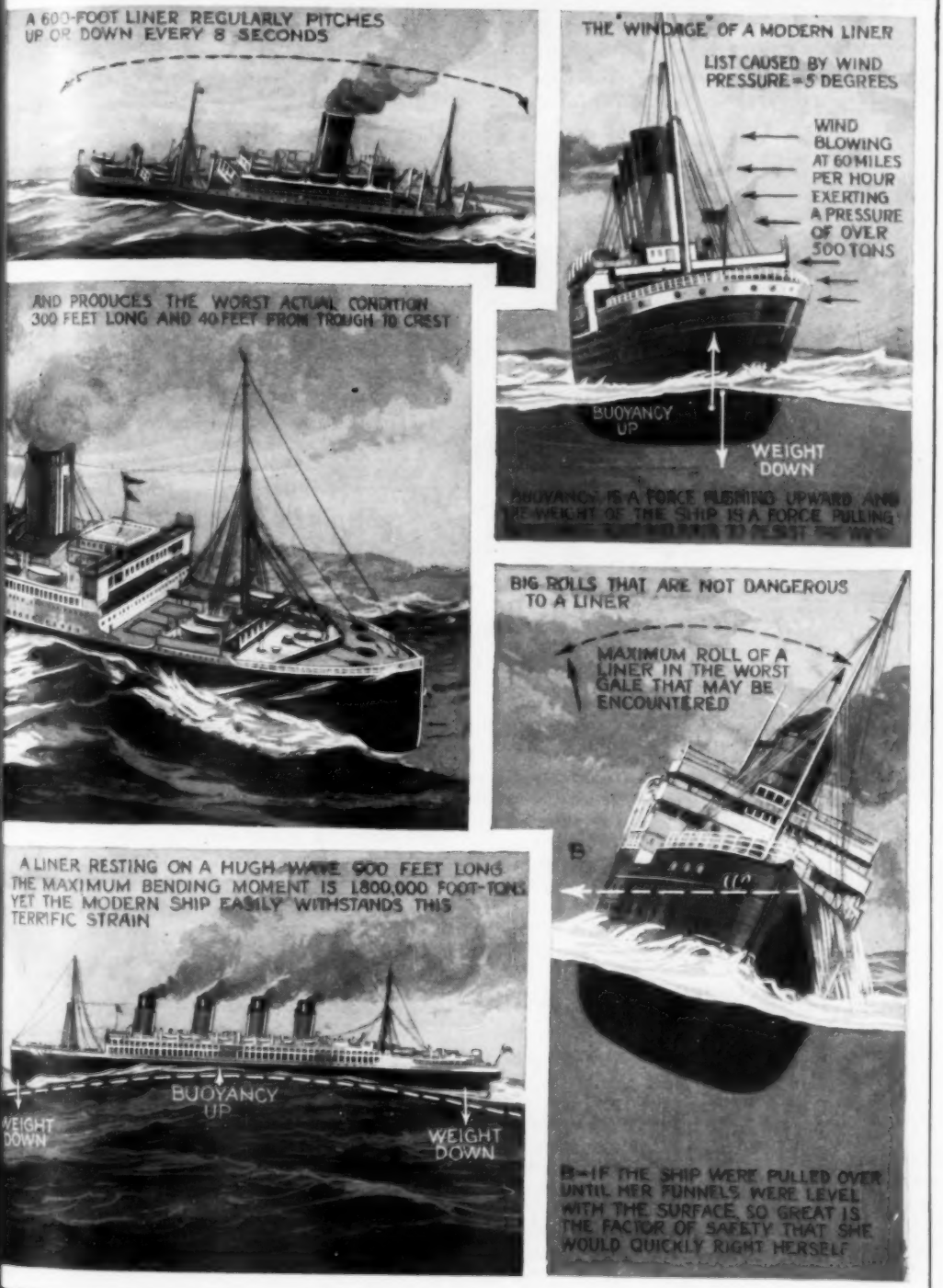



A LINER RESTING ON TWO HUGE WAVES EACH 450 FEET LONG. THE BENDING STRAIN AT THIS MOMENT IS 1,050,000 FOOT-TONS; NEVERTHELESS THE ARCHITECT HAS MADE THE FACTOR OF SAFETY NEARLY DOUBLE THIS
BUOYANCY UP
WEIGHT DOWN
BUOYANCY UP

Copyright,

Giant 900-Foot Liners Are Subject to Strains Approximating 2,000,000 Foot-Tons as They Ride the Crests of Ocean Waves, Yet Are So Stanch They Resist the Terrific Bending Pressure

United Forces of Wind and Water


A 600-FOOT LINER REGULARLY PITCHES UP OR DOWN EVERY 8 SECONDS
THE WINDAGE OF A MODERN LINER
LIST CAUSED BY WIND PRESSURE = 5 DEGREES
WIND BLOWING AT 60 MILES PER HOUR EXERTING A PRESSURE OF OVER 500 TONS
BUOYANCY UP
WEIGHT DOWN
BUOYANCY IS A FORCE PUSHING UPWARD AND THE WEIGHT OF THE SHIP IS A FORCE PULLING
AND PRODUCES THE WORST ACTUAL CONDITION 300 FEET LONG AND 40 FEET FROM TROUGH TO CREST
BIG ROLLS THAT ARE NOT DANGEROUS TO A LINER
MAXIMUM ROLL OF A LINER IN THE WORST GALE THAT MAY BE ENCOUNTERED
B
B—IF THE SHIP WERE PULLED OVER UNTIL HER FUNNELS WERE LEVEL WITH THE SURFACE, SO GREAT IS THE FACTOR OF SAFETY THAT SHE WOULD QUICKLY RIGHT HERSELF
A LINER RESTING ON A HUGH WAVE 900 FEET LONG THE MAXIMUM BENDING MOMENT IS 1,800,000 FOOT-TONS YET THE MODERN SHIP EASILY WITHSTANDS THIS TERRIFIC STRAIN
BUOYANCY UP
WEIGHT DOWN
WEIGHT DOWN

Illustrated London News

These Sketches Show How Ships Roll from Side to Side and Pitch Up and Down from End to End with the Regularity of a Clock Pendulum, Yet Are Built So They Can't Turn Over

THIRTY-FIVE-FOOT "POLICEMAN" SHOWS AUTOISTS SHORT CUT

At a street intersection on the outskirts of Topeka, Kans., a huge steel sign representing a traffic policeman informs motorists that they can save a mile by passing through the city in a certain avenue. The guide was erected by an improvement association for the benefit of merchants. It is thirty-five feet high and, being painted in bright colors, is visible from a considerable distance. Across the street, rival storekeepers have erected a large arrow pointing a route to their shops.

Putting Finishing Touches on Giant Traffic Sign; Figure Is Thirty-Five Feet High

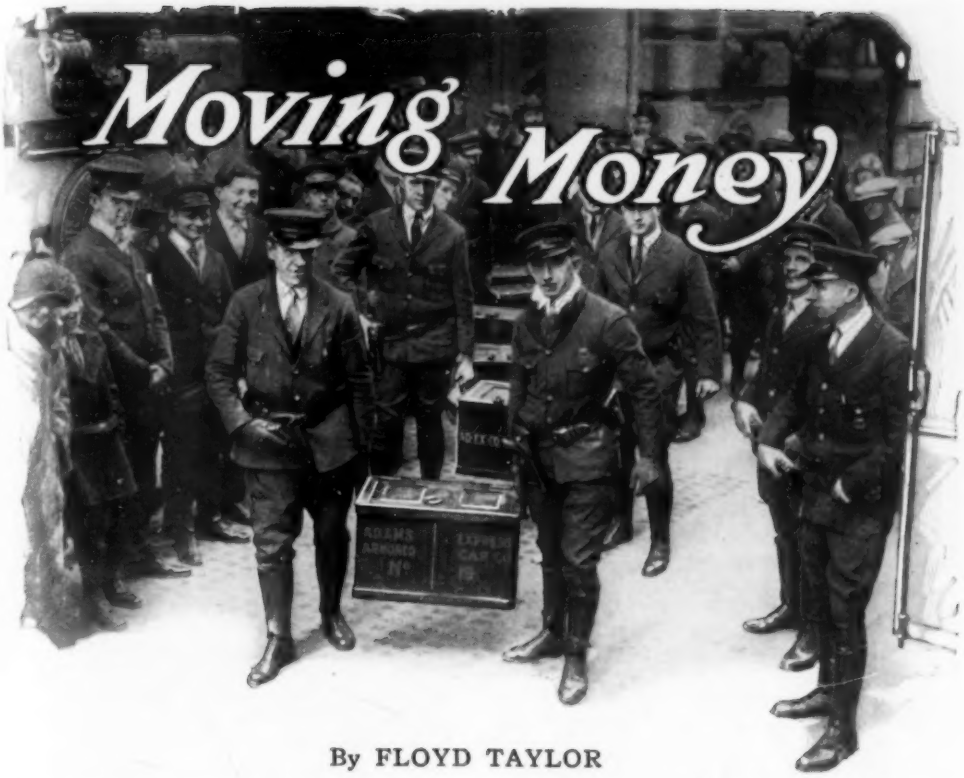
LOST PERSONS FOUND BY RADIO AS AID TO POLICE

Twice daily, from municipal broadcasting station WNYC, New York city, radio performs one of its most interesting and helpful services. At 7:30 and 10:30 p.m., an officer of the police bureau of missing persons steps to the microphone and the ether waves carry a description of any person who is lost, the date of disappearance and other facts which may help in finding him. Listeners are urged to cooperate with the police in locating the individual wanted. Not long ago, a prayer broadcast by the Rev. Dr. S. Parkes Cadman for the safe return of a boy who had run away from home was heard by the fugitive himself, who happened to be working as a bell boy in a hotel. The message, echoing through the lobby from the hotel's loud speaker, exerted a powerful effect on the lad as his own name was mentioned and he decided to go back. A woman, who had not seen her brother for forty years, told her story to officials of station WEAO at Ohio State university. In a little town in Arkansas, a daughter of the missing man was listening in when the plea for his return was put on the air. The father clapped on the headphones and listened in amazement as he heard his name repeated. He rushed to a telegraph office, sent an assuring message to his sister and took the next train for the Ohio town in which she lived. The radio appeals often supplement the newspaper accounts of missing persons, giving further facts about them.

HOLLOW FIBER SCREW PLUG HOLDS IN ANY MATERIAL

For attaching all kinds of devices to brick, concrete, marble, and almost any other sort of material, a hollow fiber plug inserted in a small hole which is first drilled, forms a gripping foundation to hold the screw. It is not affected by moisture, absorbs and resists vibrations, and will not strip the threads of the screw. It is manufactured in more than fifty different sizes, and as it becomes almost an integral part of the surrounding material under pressure, it is not likely to be pulled out. Only a small hole is necessary for first inserting it and it both saves time and permits a neater and more lasting job in fastening shelves, hooks and many similar articles.

Plug in Hole Grips Screw, and Perfect Threads Are Cut When Screw Is Taken Out



By FLOYD TAYLOR

HEAVILY armored automobiles, as sturdy as those used in the World War, are rolling over Broadway, Fifth avenue and Forty-second street carrying gold in New York. Visitors from communities where bandits are fewer stare at the steel monsters and wonder why a weapon of war is used in the city.

The answer to their question is that only by using an implement of war have the bankers and jewelers and employers with large payrolls been able to protect their money and valuables from gunmen and save the lives of their messengers.

Most of the banks now use armored cars furnished them by one of the several companies operating in New York. The guards and drivers of the cars are carefully selected men. One company hires only American citizens who have spotless records, who have passed rigid intelligence tests and physical examinations, and who are natural marksmen. They must be able to shoot from the hip with revolvers and, at short range, to hit their targets invariably.

The conductor rides inside the car with one guard. Another guard is on the seat with the driver. Each has a revolver. The driver's compartment is partly inclosed by steel and partly by three thicknesses of heavy plate glass, which is bullet-proof. There are loopholes carefully sheathed so that it is almost impossible for a would-be robber to shoot from the outside into the car.

Gun racks surround the conductor. Some of the cars have machine guns which shoot twenty-one shots a second and all have scatter-shot riot guns. One type of car has a ventilating machine over each loophole to forestall any attempt by bandits to use gas. The cars can be stopped by the conductors inside.

One company has thirty-four armored automobiles. It brought the first of these cars to New York four years ago and its only loss has been the theft of a small payroll by an employe. This company estimates it now handles an average of $8,000,000 a day. Hundreds of large payrolls are handled by the armored-car companies. They take the money from the bank, make up the payrolls in their offices, carry the envelopes to the firms using the service and, in some instances, pay the employes. They assume all responsibility for loss.

The average charge for the use of an armored car is about $75 a day. Most of

Two Hundred and Fifty Millions in Cash and Securities Being Moved from One Bank to Another a Block and a Half Away; Even the Porters Carrying the Boxes Wear Guns at Their Belts

the work is done on long-term contracts. It consists in handling payrolls, the receipts of stores and other business houses and of theaters, and the routine transfer of bank funds.

But there are many unusual jobs. Paintings and antique furniture often are intrusted to the companies. One of them moved a museum to a new home and has often taken valuable paintings by old masters from homes to galleries for exhibitions. Wealthy society women of New York use the cars to send their jewelry to and from safe-deposit vaults. A $100,000 string of pearls has been the only load for one car on several trips from

Two Hundred Million Dollars in Bonds and Securities Were Moved by This Crew in One Afternoon

Fleet of Armored Forts Invading Wall Street to Move a Bank; Right, New York City's Funds Are Guarded by Sharpshooters

a bank to a residence in the neighborhood of Central park.

The armored-car companies have their own vaults and, late at night, collect receipts from theaters and charity affairs, such as bazaars and dances. They keep the money in the vaults until banks open the next morning. But the most outstanding work of the armored cars is in moving banks, and the most spectacular of all was the transfer of $3,000,000,000 in cash and negotiable securities from the old vaults of the Federal Reserve in the Equitable building to the new home of the bank in Liberty street.

This moving job was guarded by 150 policemen, fifty detectives, fifteen members of the police bomb squad, forty bank detectives, sixty secret-service men, and the crews of four men carried by each of the thirty-seven armored cars which were used.

The work began, unheralded, one Saturday noon. The entire district was cleared of those not helping to move the bank. Sharpshooters were perched on roofs and ledges. Machine guns were mounted at every corner on the route. Four armored cars were posted at each street intersection with orders to wreck any car engaged in the moving if it turned off the route.

The money and securities were packed in trunks in the old bank vaults. Each trunk was locked and sealed by bank officials and the armored-car company gave a receipt for it as its men took it from the vault. All afternoon rubber tires rolled under the steel monsters carrying millions at each load. The hundred trips required were made between noon

and 5:00 p.m. Saturday and 9:00 a.m. and 12:30 p.m. Sunday.

Four armored cars were used when $250,000,000 was moved up Broadway last year from the vaults of the Metropolitan Trust company to the Chatham and Phoenix National bank. There were machine guns ready for action on each car and a slightly larger car, known as a "fort," was placed at Broadway and Liberty street, ready for a counteroffensive if bandits tried to raid the money cars. The work took three hours.

Bandits face capture or death if they try to rob armored cars moving bank funds. Their chances are little better in attacking cars in their routine work of carrying payrolls. They seem to have given up hope of clutching the gold that rolls through the streets protected by bullet-proof steel and machine guns.

The constant shipments of gold to and from New York by ocean liners is another temptation to bandits. The gold is placed in vaults of steel on the liners and is carefully guarded. It is taken to and from the piers in armored cars.

Some of the shipments are very large. The steamship "Mauretania" brought $20,000,000 on one trip last October. Gold coming to America from Europe is usually packed in boxes, about nine inches deep, nine inches wide and twenty inches

The Inside and Outside of an Armored Fort on Wheels: the Guard Is Armed with a Machine Gun Which Fires Twenty Shots a Second

Armored Cars Have Foiled Bandit Attacks on Payrolls and Shipments of Gold and Silver Bullion between Banks and Steamship Docks

long, and each of them holds just $50,000.

These boxes must be carried in loading and unloading. The American banks, when shipping gold, pack it in kegs, which can be rolled. The kegs are of about ten-gallon size and when filled, weigh approximately 180 pounds. In both kegs and boxes exactly $50,000 is the unit because of the necessity of facilitating counting. Thus, twenty kegs hold a million.

The United States Assay office handles the business of American and foreign banks shipping gold. Gold to be shipped abroad as bullion is taken to the office and there melted and molded into bricks. The gold is tested for fineness. Gold received by American bankers is tested at the office before it is delivered.

Sometimes gold is transferred without being remelted. J. P. Morgan & Co. once received a shipment from France of bricks which had been sent to that country seventeen years before in connection with the building of the Panama canal. A few of the bricks had been tested for the fineness of the gold; the rest had not been touched.

Gold is taken from the ships at their docks in the Hudson river to the assay office in armored cars. The kegs are rolled down gangplanks by laborers as a checker counts, "$250,000, $300,000, 350, 400, 450, half a million." The full load for an armored car is from $1,500,000 to $2,500,000. The guards who ride in the cars say that any gunman who thinks it would be easy to steal that gold is welcome to try.

BROWN EYES OUTLAST BLUE BY EXCLUDING LIGHT

Other factors being equal, brown eyes are less liable to give trouble than blue, according to a western specialist, for the dark irises act as curtains, shutting out light and thus protecting the nerves and inner structures. Blue eyes, he declares, are more often the exception to the rule that a normal eye will not need glasses until the person is forty-five years old. Special illuminating devices and gauges enable oculists to examine patients much more accurately than was possible simply by testing the vision with printed cards. They have instruments which also permit inspection of the interior of the eye for traces of disease or approaching cataracts.

RAILWAY CARS DISINFECTED IN GAS TANKS

After railroad cars have traveled 80,000 miles or so over a German line, they are taken to the repair shops where all upholstery is removed and they are given a thorough fumigation in a huge airtight metal tank. A special kind of gas, deadly to all sorts of insects and disease germs, is used, the vapor being admitted to the tank after the receptacle has been tightly closed with the car inside. The gas penetrates small cracks and fissures that could not be reached by ordinary spraying, and is left turned on long enough to rid the cars of all germs.

Copyright, Henry Miller

Upper Photo Shows End of Fumigating Compartment Being Closed After Car Is Inside; View of Interior Discloses Gas Pipes, and, at Right, Car About to Be Disinfected Halted at Entrance

PLASTER THAT ABSORBS SOUND AIDS SICK AND RADIO

To meet the demand for a wall covering that will decrease unnecessary noise, "the curse of modern hospital construction," Dr. Paul Sabine and associates at Riverbank laboratories have developed a sound-absorbing plaster, which, tests have shown, is from eight to ten times as effective as the ordinary article. It is of spongy appearance, the thousands of little chambers in its surface acting as "mufflers" for sound instead of reflecting it, as happens in the case of a smooth wall. Experiments have shown that tile with a hard plaster coating is a better reflector of sound than a glass mirror is of light. A good mirror throws back only about ninety per cent of the illumination that strikes it, while hard plaster reflects approximately ninety-seven per cent of the sound that reaches it, thus giving rise to a confusion of echoes and vibrations. Sounds of ordinary intensity in such a room, must undergo some 450 reflections before they are absorbed to such an extent as to be inaudible. This takes about 4.8 seconds. Carpets help "deaden" the noises, as they absorb about twenty-five per cent of the sound that strikes them, but their use in hospitals is unsanitary. The new plaster has also proved effective as covering for the walls of radio-broadcasting studios, as it produces about the same results as textile drapes, but does not make the room so "dead" as to discourage or frighten performers, who sometimes break down before the microphone when they do not hear the customary resonance of their own voices. Hotels also have found that the plaster is efficient in sleeping rooms where street or interior noises are likely to disturb guests. When the plaster was first prepared, it was covered with an ordinary calcimine coating. To the dismay of the scientists, it was discovered that this substance had destroyed the sound-absorbing qualities of the material, for the minute pores had been filled up. They then experimented until they found a preparation which would not stop the openings. It can be dyed to any color and coats the plaster so thoroughly that it may be washed with a damp rag without damage. To demonstrate the material, two rooms have been constructed at Riv-

erbank. They are of identical dimensions, one being coated with ordinary plaster and the other with the special mixture. There is no audible echo in the latter room, but talking in an ordinary voice while in the other, produces a confusion of sounds, and the click of a typewriter becomes sufficiently annoying to disturb anyone trying to concentrate.

AUTO TRUNK HOLDS TENT, BED AND CHAIRS FOR CAMPING

Camping equipment for two or four persons is carried in a trunk that fits on the rear of the automobile. The box holds a tent, poles, with flooring and covering included, a bed, mattress, two tables, two benches, back rest and clothes hammock, and is but thirteen by twenty-one by forty-six inches in size. The smaller outfit for two weighs only twenty-eight pounds, the larger, thirty-two. A feature of the tent is that it requires no stakes or ropes, being held by spring-steel rods that pack inside the brass poles. It has windows of transparent material and is waterproof, and the flooring may be snapped in place at the height of the bed to keep out dirt and insects. The benches and tables are formed from the trunk itself. The equipment was designed by an experienced camper and is said to have proved durable and practical after extensive tests.

Tent, Tables and Benches Shown Here Are All Carried in the Trunk on the Rear of the Automobile

Playing Automatic Concertina and View of Roll

PLAYER CONCERTINA REQUIRES LITTLE SKILL

Mastery of the concertina is considered difficult, but anyone, even without musical knowledge, it is said, can play an automatic instrument now on the market. Externally, it closely resembles an ordinary concertina, but its keys are merely placed on for form, the music being produced by a "player" roll concealed in a chamber on one side. Drawing and shutting the bellows and squeezing an attachment on the right side operates the mechanism. The tones produced are said to resemble those of the familiar instrument very closely.

ELECTRICITY CAN BE WEIGHED

It is now possible to talk of electricity in terms of weight as if it were tea or sugar, according to Prof. John Ambrose Fleming, a British expert in wireless telegraphy. He has estimated that in a year, the type of incandescent lamp commonly used for household purposes in England, would consume about an ounce of electricity.

BUILDS AIR-PRESSURE CABINET TO AID HIS HEARING

Unwilling to pay $50 for each trip in an airplane to take dives for helping his hearing, a California man has built a cabinet

Builder in Air Cabinet; Valve Regulates Pressure, Affording Practically Same Effects as Trip in Plane

in which the air pressure can be regulated at will from that at sea level to that at 12,000 feet above. Simply by sitting in the chamber and turning a valve, he receives practically the same effect as would have been obtained from the airplane ride. Doctors and aviators have found that the air-pressure treatment for the hard of hearing, usually is only temporary in its results and benefits only certain kinds of deafness. It is of aid chiefly when the difficulty is due to a dislocation of the eardrum, which may be forced too far in or too far out. Changes in air pressure cause the membrane to assume a normal position in some cases, and then hearing is improved, but in the great majority of cases the drum tends to go back to its original place in a short time.

BIG RAINS AT MUSCLE SHOALS AID POWER DEVELOPMENT

Nature has favored man's power-plant enterprise at Muscle Shoals not only with a steep descent in the Tennessee river, 126 feet in thirty-two miles, but with an abundant rainfall, so that the water supply is adequate even in the so-called dry season. The average annual precipitation over the area is more than fifty-two inches, about fourteen inches in each of the winter, spring and summer seasons and ten in the autumn, making it one of the best watered interior regions in the United States. The shoals occupy the district between Decatur and Florence, Ala. Wilson dam, erected just above Florence, with a height of 102 feet, is capable of producing 624,000 horsepower. The barricade has formed a pool which extends upstream fifteen miles and backs up the river water fifty-four miles above Decatur.

RAISING DOGS FOR THE WORLD IS BIG BRITISH INDUSTRY

It is estimated that the dog industry in Great Britain, directly and indirectly, provides employment for approximately 150,000 persons, and that the value of the pets on hand and in shipment is nearly $10,000,000. Every day, dogs are shipped to foreign ports. In one week, not long ago, two Pekingese were sent to Kashmir; a pack of twelve foxhounds to Bagdad; thirty-two harriers to Berlin; whippets to Australia; a sheep dog to Paris and setters to Patagonia. The United States is the best customer, and Indian princes are second. An American buyer recently purchased a British-bred terrier for nearly $5,000, and a chow commanded almost twice that sum. Special kennels are constructed for the dogs to meet the demands of the journeys. Warmly lined and weather-tight containers, with a system of ventilators arranged to provide a supply of fresh air no matter where the kennel is placed, are built for shipments to Labrador and other cold regions, while dogs going to the tropics need kennels with open fronts and sun blinds.

POURING SPOUT FOR TUMBLERS AIDS IN FILLING BOTTLES

Liquids can be poured from tumblers into narrow-necked bottles or other receptacles without spilling by fitting a small wire spout to the rim of the glass. It guides the contents in a small stream away from the side of the holder, directing it accurately. The attachment can be put on or taken off in a second and fits edges of different thickness.

Government Topographical Engineers at Work at the Crest of a Colorado River Rapids on the Maps Used in Planning the Vast Reclamation Scheme and Electric Power Development

Taming the Grand Canyon's Torrent

The Colorado, Navigated But Three Times, to Be Harnessed for Power, Irrigation and Flood Control

TRANSFORMATION of the landscape in seven western states is involved in a newly launched government project for controlling the Colorado river—the most difficult stream in the United States. The changes will include the creation of thirteen lakes, with an area of more than 2,000 square miles, and with a linear length close to 900 miles. These bodies of water will lie between Green river, Utah, and Parker, Arizona.

Of chief interest to the everyday citizen is the evolution proposed for the Grand Canyon. For more than 200 miles through this giant chasm, the Colorado is a stream of death-dealing violence. Successful passage of the treacherous channel has been achieved but three times in history. Pioneer journeys were made in 1869 and 1871 by Maj. John W. Powell, the first to accomplish the dangerous voyage. Since his trips, the sole expedition to pass through in safety was that of the United States geological survey in making the explorations for the present plan of development. Adventurous explorers had attempted the passage at various times during the last fifty years, but had never returned. The death toll has been extensive.

The project includes the creation of lakes within the canyon, with resultant ease of access for tourists and sightseers. With these lakes brought into being, the voyager will be able to traverse the full length of the gorge. Motorboats and comfortable travel will replace the perils of the present condition. In the transformed canyon, the general public will be able to explore the marvels of the chasm with none of the danger now rendering such trips prohibitive.

The creation of lakes within the canyon area will come as a by-product of one of the greatest engineering enterprises ever undertaken. In the 250 miles of the present danger zone, there will be eight dams, forming an almost continuous flight of steps in a descent of 2,500 feet and backing the water of the river into a series of lakes from fifteen to 180 miles long.

In point of size, the largest dam is that at Glen Canyon, toward the eastern edge of the Grand Canyon area. This structure is planned on gigantic lines, with a sheer height of 386 feet, and with underground foundations extending seventy-seven feet to bedrock. To build the foundation will involve the pouring of 10,000 cubic yards of concrete each

One of the Boats That Made the Canyon Trip, Above; Surveying a Side Canyon, Center, and the Muddy Flood Waves, Below

working day during the season of low water. The lake created by the Glen Canyon dam will extend for a distance of 180 miles upstream.

Other dams scheduled in the Grand Canyon region include: Redwall, 222 feet high and with thirty-five-mile lake; Mineral Canyon, 345 feet high, with forty-six-mile lake; Ruby Canyon, 286 feet high, with twenty-five-mile lake; Specter Chasm, 223 feet high, with twenty-four-mile lake; Havasu, 209 feet high, with twenty-three-mile lake, and Devil's Slide, 163 feet high, with nineteen-mile lake. Between Havasu and Devil's Slide will come Bridge Canyon dam with sheer height of 566 feet, equivalent to a building of more than forty stories. The lake created by it will be seventy-seven miles long.

The dams within the Grand Canyon area constitute but a part of the mighty structures contemplated in the government plan. In the upper reaches of the river, the project calls for a dam 512 feet in height, located at Dark Canyon, Utah, establishing a lake 150 miles in length. Below Devil's Slide there are four dams, creating lakes ranging up to 100 miles.

The extent of the scenic changes is colossal, but this is of minor importance in comparison with the economic and engineering problems to be solved by the great undertaking. That the lakes should carry tourists to places now inaccessible is purely incidental. The primary purposes are flood control, irrigation and the development of electrical power.

The forces of the Colorado are enormous. As a flood menace, the river is regarded as the most dangerous in the United States, a circumstance produced by conflicting elements in nature. Southeastern California sees the conflict at its worst. In this portion of its course, the river flows along a channel several hundred feet higher than the lower-than-sea-level environment of the Salton sea. The sole protection to the low-lying area is in the silty banks of the stream, which have long defied protective efforts on the part of engineers.

Between the unsubstantial banks, the river has a way of raising itself to new levels through the deposit of sand and silt brought down from its mountain channel. There are times when the deposit

One of the Dam and Power-House Sites, Showing How a Lake 209 Feet above the Present Water Level Will Be Impounded by a Wall across the Narrow Limestone Canyon

lifts the bottom of the river to the point of danger, and causes the stream to eat its way through the banks with resultant inundation of the country below. In the most recent flood of this character, the damage amounted to millions of dollars, and it was two years before engineers succeeded in repairing the breaks and restoring the stream to its normal channel leading to the Gulf of California. The danger of recurring floods is ever present, and this is one of the primary requirements for control of the Colorado through engineering skill.

Flood control is contemplated through the agency of the vast dams and lakes involved. The lakes will act as reservoirs for storing surplus water in times of high flow, permitting gradual discharge at a rate that will involve no flood peril. This, of itself, offers good reason for the attempt to control the river.

Of similar importance is the irrigation feature of the project. The river rises in 14,000-foot mountains and flows for 1,700 miles through desert country where fertile soil awaits but the magic gift of water. The storage reservoirs are planned to furnish water as needed to vast areas within reach of irrigation ditches, giving crop production of something like $400,000,000 a year, and reclaiming waste land of a potential value of hundreds of millions. The acreage involved is 6,000,000. In such portion of this area as now possesses irrigation facilities, the present condition does not supply the water that is needed. Existing regulation methods fail to overcome the dry-year shortage. Through the construction of the thirteen new dams, treating the river as a whole, there will come constant impounding of the water at times of greatest flow, and discharge will be regulated by local requirements.

In the production of electrical energy, the storage plan has an importance in no way secondary to its function in the matter of irrigation. Engineers figure that, without the lake-reservoir storage facilities, it will be impossible to develop more than one-third of the potential energy of the Colorado. The proposed dams will provide more than 5,000,000 horsepower, and allow the same waters to be used for reclamation purposes.

It is not in the Grand Canyon alone that the artificial lakes will provide new accessibility for scenic wonders of the west. Another notable instance will be in the case of the Rainbow Natural Bridge, now out of reach except by well-organized pack travel. Under the influence of the Glen Canyon dam, the river will form a lake extending to a point within one mile of this natural wonder, bringing the bridge within easy reach of tourists and sight-seers.

Rainbow Natural Bridge is the world's chief treasure of its kind. For size and symmetry of proportions, this sandstone arch surpasses all other natural bridges in existence. With a span of 208 feet and a height of 309 feet, this arch has a spread that would accommodate the dome of the United States capitol, with room to spare.

Engineers state that the transformation of the Grand Canyon will be chiefly a matter of accessibility. The lakes will be deep enough for boats, but without appreciable impairment of the vast depth of the canyon itself. No scenic damage is involved in the proposed undertaking.

The project is the result of twenty years of exploration and study.

AIR RIFLE SHOOTS FLAT BULLET TO KILL SMALL ANIMALS

Shooting a specially shaped flat lead bullet of .22 caliber, a high-power air rifle that

Air Rifle, at Right, and Its Bullets Compared with .22-Caliber Shells

pierces half an inch of wood at a distance of ten feet or kill rats and other little animals at close range, has been developed for target practice and small game. It is not a toy, yet it is not classed as a firearm under the law, for the bullets are made as blunt as possible on the front end, as light as their diameter permits and hollow at the base, so that the air will reduce their speed. This is just the reverse of the pattern of bullets intended for killing. The air rifle's pellets fall to the ground before they have gone a distance of half a city block. The gun is about the size and shape of an ordinary repeating rifle. The stock is used as a lever to pump up air pressure in the tube, which occupies about the same position as the magazine in a real rifle. Bullets are inserted by opening a bolt similar to that of the military weapon.

RADIO PROGRAM IS PRESERVED FOR FUTURE ON STEEL BAND

Tune in and listen later. This is the possibility a recent radio invention by two Viennese experts holds for the fan who may want to enjoy a program days or months after it is broadcast. Concerts are recorded on magnetized steel bands somewhat like motion-picture films. They are drawn through the electromagnet of the earphone so as to be magnetized in accordance with the impulses from the receiver and before the headphone magnet turns the vibrations into sounds. The band may then be run through another electromagnet, resulting in the production of the tones as they would have been heard at the time of the broadcasting. With this arrangement, selections may be sent through the radio transmitter directly from the steel band, thereby insuring the best performance, as repeated records may be made to get an errorless performance, and the bands may be demagnetized and used to record other programs.

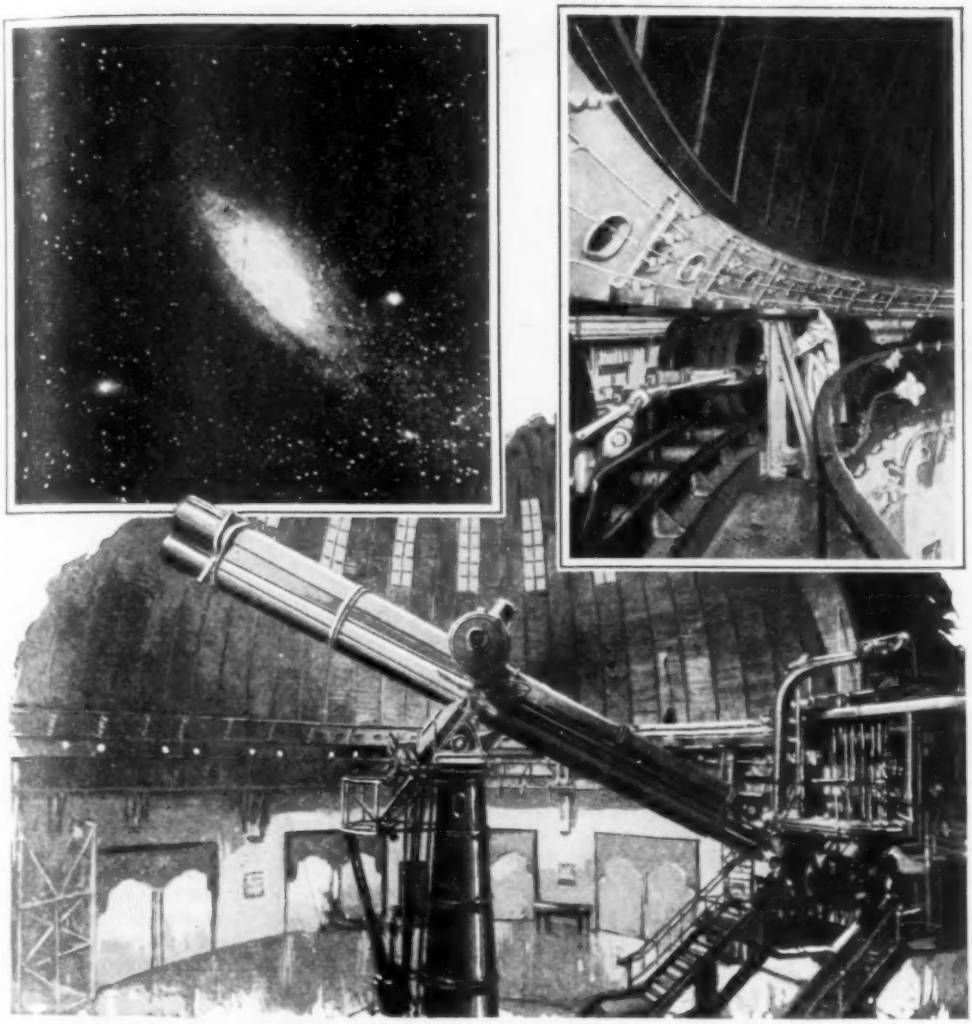
HOW INSECTS CHANGE GARB SHOWN IN EXHIBIT

Remarkable changes which various kinds of insects undergo during their life cycles are portrayed in a special exhibit at the University of Illinois. The display solves what sometimes seems to be a mystery to the lay mind, the evident disappearance of injurious bugs or worms. Usually, the creatures have not gone away, but have simply taken on a new disguise as part of their regular development. For instance, some varieties pass through four stages, the egg, larva, pupa and finally the adult. Butterflies, moths, beetles, flies, ants and wasps pass through this cycle, which is known as a complex metamorphosis. Grasshoppers and chinchbugs lay eggs that produce creatures which, except for the absence of wings, have all the external structures of the adult.

FIND USE FOR OLD LIGHT BULBS AS FIRE EXTINGUISHERS

Like the abandoned razor blade, the old electric-light bulb is a nuisance in many families, but a German engineer has discovered a way to make them useful. He fills the burned-out lights with a chemical, seals the opening and obtains an effective "bomb," which, hurled into a blaze, quickly reduces the flames as the glass bursts and liberates the chemical.

Where the Stars Are Catalogued



Courtesy The Sphere

One of the Great Celestial Mysteries Potsdam Astronomers Are Studying, a Spiral Nebula; Part of Mechanism That Moves Dome and Side View of Huge Refracting Telescope

UNDER three great domes of an elaborately equipped observatory at Potsdam, Germany, scientists are at work nearly every night when the heavens are clear, trying to solve the riddles of the stars. Many of the important astronomical discoveries of recent years have been made here. The institution was founded in 1874 for the purpose of investigating the physical structure of the sun and stars. With a huge telescope and other instruments, the observers not only seek for heavenly bodies, but try to find out of what substances they are made. Fixed stars are catalogued according to their brightness and the light of variable ones is carefully studied. One of the important aids to this research is a huge convex lens so adjusted that it collects the illumination from stars, too slight to be seen by the unaided eye, focuses it down to a clear little point, which is then split up by means of a special prism into some of the colors of the rainbow. This band of colored light is photographed and the result studied under a microscope. The colors give the scientists a clue as to the elements the stars contain. One of the huge domes is turned on a series of twenty trucks, each with three rollers a yard in diameter. All the domes are rotated on their vertical axis.

In Case of Dispute over Ownership of Umbrella, the Young Woman's Photograph Would Aid in Identification

OWNER'S PHOTO ON UMBRELLA TO PREVENT LOSS

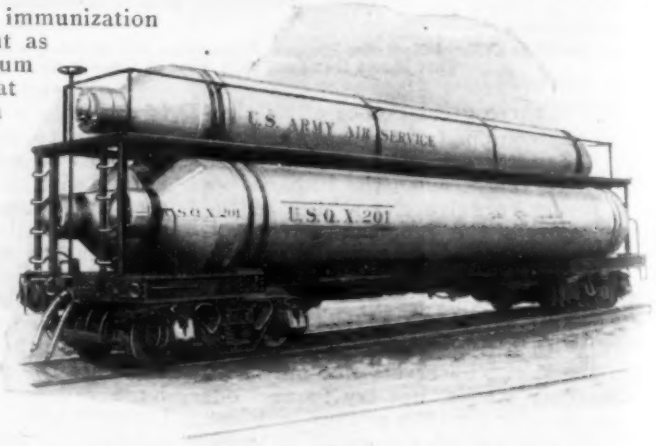
To protect her umbrella, an eastern young woman has placed her photograph on the outside, so that identification will be simple in case of loss or theft. It does not interfere with closing the shade, is securely fastened and affords a novelty.

SERUM TO COMBAT LOCKJAW HAS LASTING EFFECT

Complete and durable immunization against lockjaw is held out as a possibility from a serum which has been developed at the Pasteur institute in Paris. It is said to contain microbe secretions that not only kill the germs of the disease, but also protect the subject by fortifying his system against them in case he should suffer a scratch or wound liable to expose him to lockjaw. Both horses and men are reported to have been treated successfully with this serum, which was prepared after six months' experiments. According to one of the scientists responsible for its discovery, the serum would have saved thousands of lives had it been used during the World War, and he believes that it will be of great benefit to athletes or others suffering skin abrasions or wounds in which the tetanus germs may find entrance to the system.

BOTTLE CARS FOR HELIUM GAS AID AIR SERVICE

To supply army and navy dirigibles with helium gas from the production plants in Texas, a special type of railway car has been constructed. It consists of three large bottle-shaped cylinders with a combined capacity of 201,000 cubic feet of gas, which is forced into the containers under a pressure of 2,000 pounds to the square inch at a temperature of seventy degrees Fahrenheit. Each cylinder is thirty-nine feet three inches long, and the outside diameter is four feet seven inches. The walls, of high-grade steel, are two inches thick, and the endpieces around the valves are held with high-strength nickel-steel studs. Six of these special helium cars can carry enough gas to inflate airships as large as the "Los Angeles." The weight of the entire car is approximately 200,000 pounds, but only about 2,000 pounds of this is represented by the helium. The tanks have a volume of about 507 cubic feet. The cars are easily routed to the various airdromes about the country, and simplify the work of the balloon crews, who had to manage containers of different shapes and sizes and did not know exactly how much gas was being shipped until it was released.



Special Tank Car for Carrying Helium Gas to Dirigibles

What Makes a Radio Tube Good?

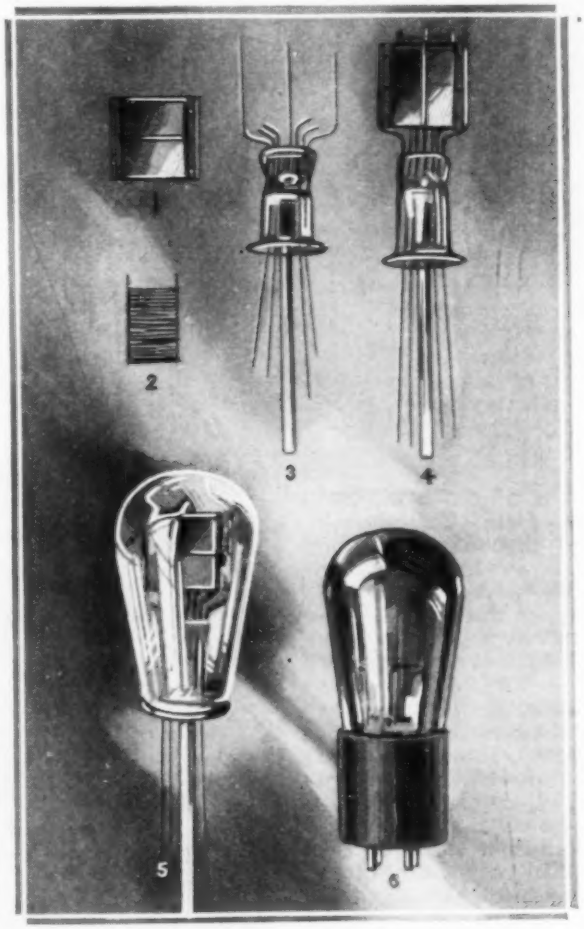
Selection for the Particular Task of Each Socket, and Proper Care and Control Necessary to Get the Best Results

WHY some radio tubes are better than others and why some tubes work well in one socket, but upset the operation of the entire set when shifted to another, are two of the first mysteries confronting the owner of a receiving set. The explanation may lie in any one of a dozen factors which influence the operation of the tube. Or it may go back to the making of the tube at the factory, for it is virtually impossible to produce these delicate electrical valves to exact specifications. Some are bound to be better than others, though the others are not necessarily bad, provided all tubes used in the set are fairly well balanced as to capacity.

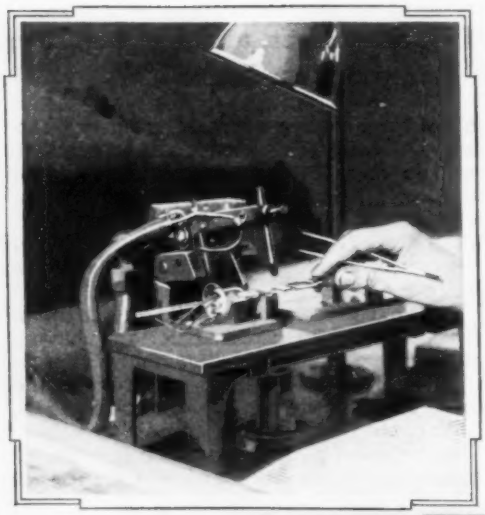
Much of the work in making tubes is done by automatic machinery, to reduce the chances of human error, but even the best machinery cannot get around the slight differences in the electrical characteristics of different pieces of wire.

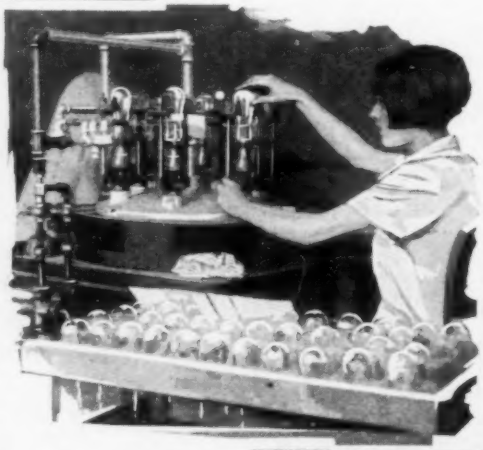
There are three general kinds of tubes in use for receiving sets, those taking six volts, three volts and one and one-half volts of A-battery current to light the filament. The six-volt tubes are the large ones used with storage batteries for most home sets. The smaller were developed primarily for portable receivers, because they can be operated from dry batteries. None of the latter are as efficient, nor do they last as long, as the six-volt size, so that their use is seldom recommended, except where lightness and portability are desired, or where, for other reasons, it is not practical to use a storage battery.

All of the tubes are alike in the main features of their construction, having three elements, the filament, which is lighted by the A-battery, and a plate and grid. In operation, the tubes act as valves, in fact they are known abroad as valves. The heated filament gives off streams of electrons which bombard the surrounding plate. Between the filament and plate, however, is a fine network of wires, forming the grid, and corresponding to the valve gate or shutter. When the grid has a negative electrical charge, the electrons from the filament are repelled, failing to reach the plate. As the grid potential changes to positive, the electrons pass through to complete the circuit. The opening and closing of this electrical shutter proceeds at a very high rate, the higher the better, up to a certain point, when oscillation sets in, and, in a regenerative receiver, the oscillating tube becomes a miniature broadcast-



Six Stages in the Making of a Radio Tube, Starting with the Plate and Grid and on through the Assembly of the Parts





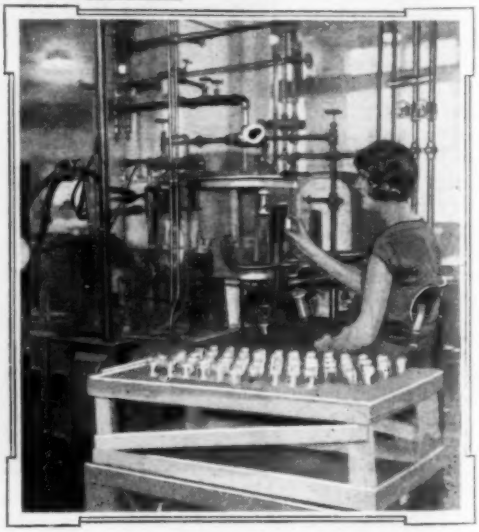
The Electric Welder Which Fixes the Joints as the Tube's Insides Are Assembled; Adding the Outer Bulb, Center; and, Below, Pumping Out the Air and Sealing the Tube

ing set and begins to annoy all the neighbors by creating howls and whistles in their receivers.

Oscillation may be controlled by the use of a potentiometer, which gives a delicate control of the grid potential and enables it to be balanced up to the highest point at which the tube will operate, and then held there. Tubes work best on the ragged edge of oscillation, where a slight shift would send them over the border. The potentiometer enables the tuner to reach this point of adjustment as accurately as the vernier control on the tuning dials provides better tuning.

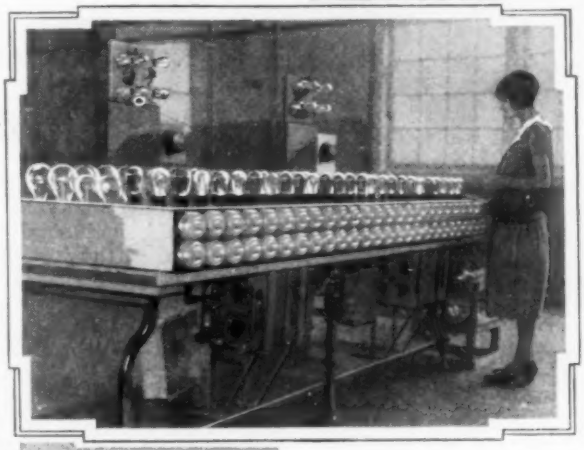
Tubes are as delicate as the old-time tungsten lamps in their early days, and, like those early lights, should only be operated in a vertical position. Otherwise the heated filament, expanding as its temperature rises, is apt to sag and touch the grid wires, causing a short circuit within the tube. Slight shocks often break the wire members, and for this reason spring or sponge-rubber base sockets, or strips of sponge rubber under plain sockets, prove safest. Changes in battery connections or wires within the set should never be made without first removing the tubes, to prevent their being blown out by short circuits. After repairs or changes have been made, a single tube can be placed in each socket in turn for test, and if it lights safely, the others may then be installed. In this way not more than one tube will be lost if there is anything wrong with the wiring.

The life of a tube depends upon the time during which the filament will continue to give off electrons, but this may be extended by rejuvenating the tube, provided it is a 201-A or 199. The volt-and-a-half tubes cannot be revived. Since 1922, most of the tubes manufactured have had filaments composed of tungsten treated with thorium, because the latter material has an exceptionally high discharge of electrons. After some months' use, the number of electrons will drop, but more thorium can be brought to the surface by putting the tube in a rejuvenator, which subjects the filament to a higher voltage for a few seconds, and then to its standard power for a quarter of an hour or so. For a set used fairly regularly, rejuvenation two or three times a year is not too much.



The new-model tubes differ considerably from those which have been in use since the earliest days of broadcasting. They have longer prongs, and the filament prongs differ in size from those for grid and plate. The new sockets are flat, having four holes into which the prongs are thrust, and the difference in size makes it impossible to put in the tube in any but the right way. The pin on the side of the tube, which locks in the slot of the old-style sockets, is retained, so that new tubes can be used in the sockets of existing sets.

Many of the new sets are being built with fewer rheostats, using fixed resistances as ballast in the amplifying stages, to regulate the filament current, passing the necessary amount for the tube. Where rheostats are used, the 201-A tubes, consuming .25 ampere, should have twenty to forty-five ohms' resistance in the rheostats. The 199-tubes, with a current consumption of .06 ampere, can use the same size, while the UV-200 and the C-300, both so-called "soft" detector tubes, take six-ohm rheostats. When three or more 199 or 201-A tubes are served by one rheostat, the resistance needed is only six ohms, and five or six of the tubes together take three ohms.



The Base Is Added Last; Center, Seasoning the Filaments by Cooking Out the Thorium; Below, the Final Test

Power tubes, which are now coming into general use, afford higher amplification without distortion of the reception. They are used in the final stage of the set. They do not actually amplify any more than the other tubes, but are so constructed that they can pass a greater volume of sound without distorting it.

One of the mysteries to many radio users has been the silverlike mirror which lines the glass bulbs of all but the soft detector tubes. It has nothing to do with the operation of the tube, nor does its gradual disappearance, particularly above the plate, indicate that the tube is nearing the end of its life. The film is merely an accident attendant to a novel method adopted to obtain an unusually high vacuum in a short time when the tube is pumped out, a method which has made possible the thoriated-tungsten filaments at a reasonable price.

All the early tubes employed either

plain tungsten or carbon filaments. Tungsten gives a bright white light, as in Mazda lamps, and the carbon filaments a dull-red glow, as in the old-fashioned carbon electric light. Hence one kind of tube became known as a dull emitter and the other as a bright emitter.

In the search for a better filament material, the discovery that thorium would throw off large quantities of electrons was made, but it likewise was found that minute quantities of gases released from the surfaces of the plate and grid, after the tube was pumped out, had a bad effect on the operation of the composition filament. To get around it by pumping out the tube to a higher vacuum would have meant hours of pumping on each tube, slowing up production and more than doubling the retail price of tubes.

The difficulty was solved, however, by attaching a tiny piece of magnesium paper, ordinary flashlight material, to the plate before the tube was assembled. The air is then pumped out, and when the tube is nearly exhausted an electrical coil is slipped around the tube. The metal of the plate, in the center of the magnetic field of the coil, becomes heated through the electrical action, and touches off the tiny flashlight, the explosion blowing out the last of the gases. The result, however, is a silverlike film on the glass tube, the film being the particles of magnesium from the flash.

The early thoriated-tungsten tubes were good for not more than 200 hours' service, but with the new method of construction, the average tube is good for at least 1,000 hours, and many will serve faithfully for twice that period.

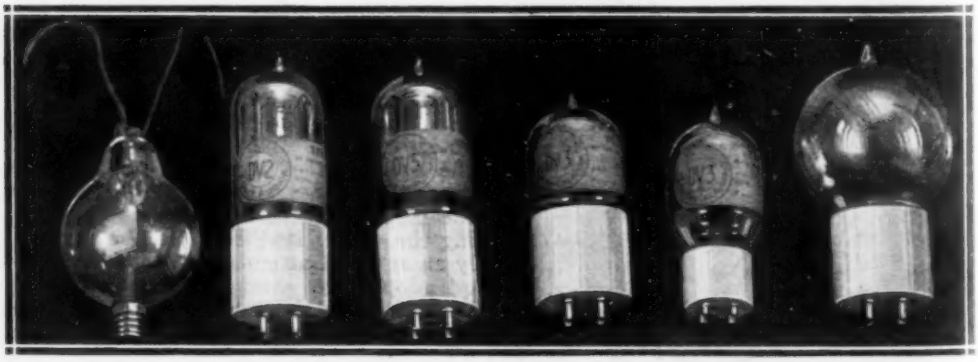
In selecting tubes for a multi-tube receiver, they should be carefully balanced. An eight-tube receiver with all tubes registering a capacity below the average, but all evenly balanced, is better than one with seven tubes above the average and one poor one. Practically every dealer is equipped with a tube tester, and the buyer should himself check the testing and pick the tubes which come nearest to a general average.

If this precaution is observed when buying the tubes; if they are not forced by turning up the rheostats farther than necessary; if they are rejuvenated occasionally as needed, and if ordinary care is observed in handling them on the occasions when they must be removed from their sockets, modern radio tubes should last for from one to two years, or longer, with average use of the set.

They have been made as nearly foolproof as is humanly possible, but radio tubes remain one of the most delicate scientific instruments ever developed for use by the layman, and should be treated accordingly.

SOLVING MYSTERIES OF PLANTS TO AID HUMAN BEINGS

In an interesting laboratory in England, plants are being subjected to a wide variety of tests, while scientists study their growth and how they respond to various lights and different kinds of food, that plant products may be raised more efficiently and, incidentally, that more may be learned of the functions of the human body, for life in plants and in animals is similar in some respects. A geranium with a curved stem is given an electric shock and made to grow in a different direction; certain plants that require light for normal growth are placed in darkness, while others that could do well with little illumination are subjected to baths from colored arc lamps. To discover how plants feed, the experimenters starve them.



Courtesy the DeForest Laboratories

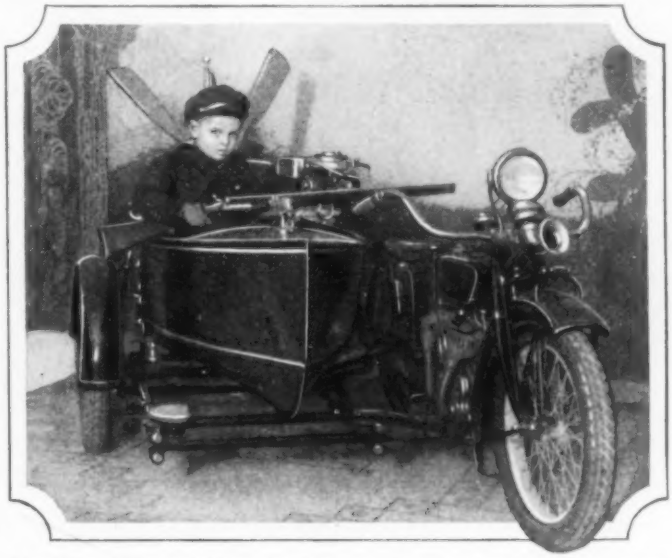
The Grandfather of All Tubes, Dr. Lee DeForest's First Audion Tube, Invented in 1906, on the Left, and Five of His Latest Models Alongside; the Radio Tube Is Just Twenty Years Old

SEEK "VILLAINS" OF PLANT LIFE TO CURB DISEASES

Hoping to save millions of dollars now lost every year in trees and crops destroyed by disease, scientists at the Boyce Thompson institute for plant research are seeking the cause of various ailments that afflict vegetables, corn, peaches and other products. An intensive study is being made of the so-called virus diseases, the "yellows" and "mosaics" which annually destroy acres of crops. While the origin of these has not yet been discovered, the investigators say that it may be found in some form of bacteria so small as to be invisible even under the microscope, or it may be a virus or disturbance in the physiology of the plant itself. One "villain" of flower life already has been identified. It is a particular kind of leaf hopper that causes "aster yellow." Although it is known to spread the disease from plant to plant, just what is spread and how are mysteries. Tests have shown that no other kind of hopper or insect is capable of infecting other plants. The leaves of the beet curl, cranberries develop false blossoms, potato leaves roll, tobacco mottles deep and light-green, peach and aster leaves yellow and shrivel, and all these maladies seem to be related in some way just as human diseases, yellow fever and malaria are transmitted by the bite of the mosquito. The experimenters have found that when young plants develop one of the diseases they may die, but older ones merely languish, producing smaller leaves, blossoms and fruit. Plants grown from tubers and cuttings, such as potatoes and sugar cane, may struggle from year to year and the disease tends to become more severe. It is more disastrous to perennials than to annuals.

MOTORBOAT AS CYCLE SIDECAR IS EASILY DETACHED

For campers and sportsmen, a motorcycle equipped with a motorboat sidecar, solves the question of hauling the craft to and from lakes and streams, and permits enjoyment of a greater variety of pleasures with but little added trouble. The boat can be quickly taken off or attached, and where passable roads are available, the outfit relieves travelers of the task of portages when cruising waters navigable only in sections.



Motorboat Serves as Sidecar for Cycle and Is Ready for Use When Riders Reach Lakes or Streams

LEVER PEN FOR WRITING SIGNS REQUIRES LITTLE SKILL

Even novices are said to be able to letter signs attractively and neatly with a special pen now on the market. It is used like a pencil, has a lever on the side for filling the ink chamber, and its point consists of a number of small teeth so adjusted that both light and heavy lines are easily made and shading is done almost automatically. Various sizes of points and a special kind of ink are provided with the lettering outfit.

Sign-Lettering Pen and Samples of Work It Does; Almost No Skill Is Needed

SAILBOAT BUILT ON TRICYCLE TRAVELS LAND OR WATER

Tricycle Yacht Constructed by a Dutch Workman Who Rode It from Holland to Paris

Mounted on a tricycle, a yacht constructed by a Dutch workman, "sails" both on land and water and recently carried its owner from Holland to Paris. Foot power is utilized for propulsion when the outfit is in the water in addition to the sail, and as the hull clears the ground, it is easy to ride on the street.

HARD COAL IN PENNSYLVANIA ENOUGH TO LAST CENTURY

Pennsylvania deposits contain sufficient hard coal to last 110 years, according to a report prepared by the forest and waters department of that state. It is estimated that there are 16,354,676,000 tons of anthracite in the ground and that more than half of this is recoverable. The original content of the field is believed to have been more than 20,000,000,000 long tons. Improved mining methods are reducing the amount of coal lost each year. In the early days only lump anthracite was shipped, the smaller sizes being left in the mines or carted to the dumps. During the past five years, even fine silt has been reclaimed and burned under boilers by forced draft. Much coal must be left in the mines in the form of pillars to support the shafts, and in other places the proximity of streams prevents digging, as seepage would flood the passages.

ASSEMBLING DINOSAUR'S BONES WILL REQUIRE TWO YEARS

Scientists who are piecing together the skeleton of a huge dinosaur, found about three years ago in northeastern Utah, face a two years' task before the restoration will be ready for display in the Washington museum. Missing parts must be modeled in material that will fit in with the real bones, and the whole skeleton is being constructed to correspond as exactly as possible to that of the original animal.

Fitting Together Bones of Huge Dinosaur for Museum Display; Missing Pieces Must Be Molded, and Incomplete or Broken Ones Reconstructed, So That Finished Work Will Be Accurate

Shattering Tile-and-Concrete Floors on Top of Doomed Building under Blows of 500-Pound Weight Dropped from Top of Breaker Arm; Wreckage Falls into Trucks on Floor Below

Experts Are Required to Demolish Big Buildings to Make Room for Growing Cities

By PAUL PADDOCK

A BIG tractor stops abruptly at a chute, the body tips, and two tons of broken bricks roar down into a river barge. A ponderous concrete breaker drops a 500-pound weight, and a section of tile flooring crashes. Five caterpillar trucks, some loaded with brick and others dragging steel beams, clank their way through a confusion of timbers. A compressed-air gun chatters, and a concrete wall built for eternity, tumbles into a dusty heap.

Such a scene might be duplicated almost anywhere, but this particular one is being enacted nine stories above a Chicago street on top of a huge warehouse, a fireproof structure built of steel, brick and concrete. Although only a few years old, it has been doomed to destruction to make way for a driveway. The task of undoing what took the builders many months, had to be done in sixty days. A penalty of $1,500 a day was imposed for overtime. But the wrecking experts did it with ample time to spare, demonstrating what skill and modern equipment can accomplish when structural processes are reversed and the object is destruction.

There are more tricks to the trade of wrecking than the layman suspects, the foreman of this job declared. His company has been destroying buildings at the rate of more than $4,000,000 a year to make room for city growth. Wrecking is almost as old as building itself, but modern steel construction has created new problems. The feat of carting away the remains of a big building through congested traffic is, in itself, a mighty task. In fact, the foreman declared, getting rid of the rubbish is the first big trick of the business.

Before actual work starts, a skilled estimator visits the building and sizes up its salvage value. He must know markets and materials, have a keen eye for the worth of such equipment as elevator mechanism, boilers and plumbing. His company often acts as a merchant, buying a big building for its wrecking value and selling what comes out of it. Millions of dollars' worth of junk is scrapped from doomed buildings. Sometimes almost priceless materials are to be found in old mansions where magnificent woodwork was lavished unsparingly in their interior. The estimator must be an authority, to some extent, on art. On his report, the company either contracts to take the job with the salvage or agrees to do only the wrecking. The decision

Swift Hopper Tractors Dump Debris Directly into Chutes to Barges or Trucks Below, Speeding the Work on Big Jobs

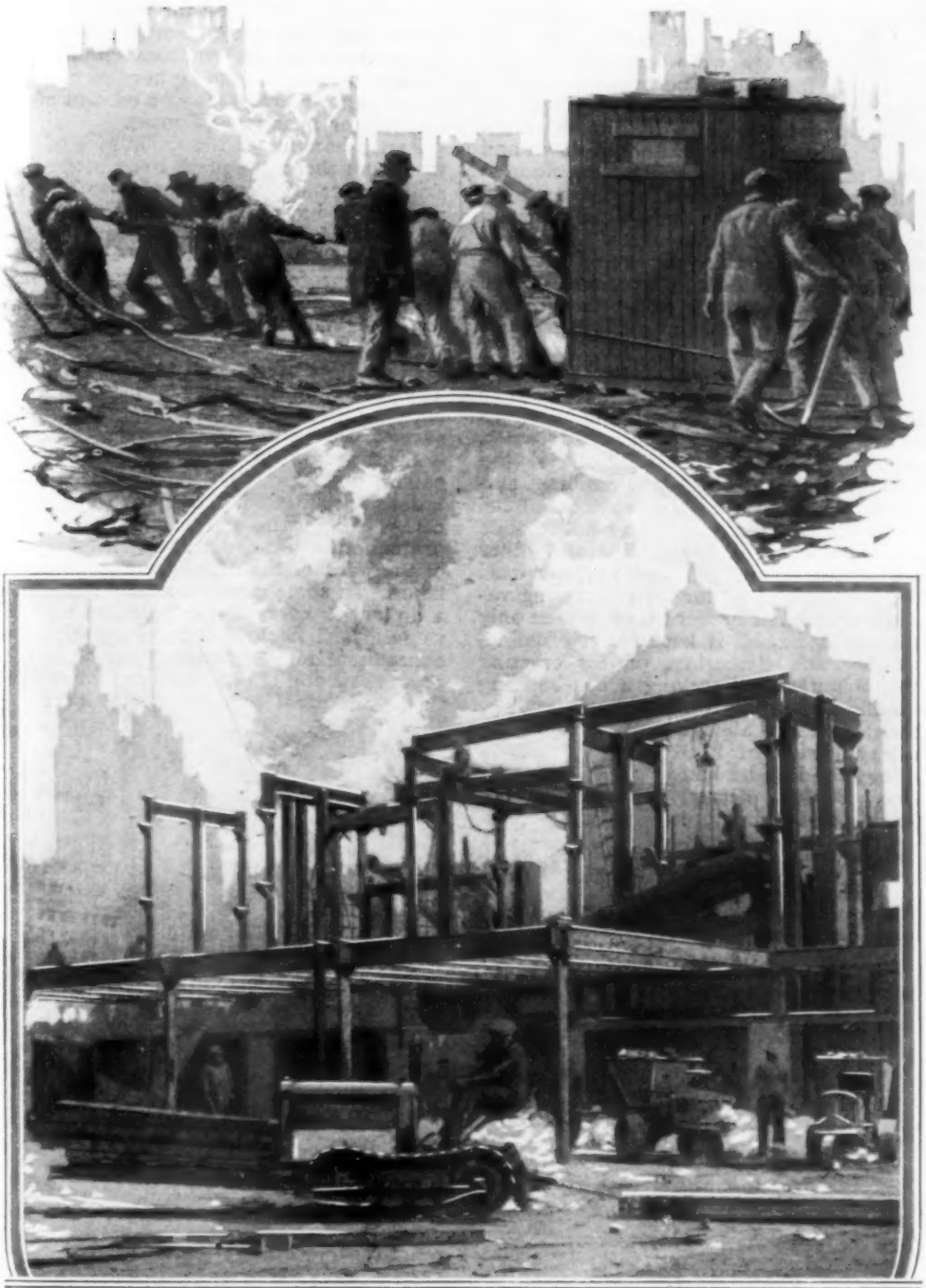
often means the difference between a profit and loss.

The first step in destroying a building is to take out the windows. Plumbing may follow while workers begin to strip the roof. Wreckers consider the roof of most buildings equivalent to two stories, for fewer men can work upon it, there is greater risk, and its destruction is more difficult. As the job progresses, it is evident that the popular conception of a wrecker as only a stalwart laborer, proficient with the pick and crowbar, is wrong. He must be able to scale high walls, stand on an eight-inch ledge and calmly dislodge the bricks beneath his feet without falling. Often he must climb to perilous positions to burn out rivets with acetylene torches. Hazards of falling walls surround him, for strains and stresses cannot be accurately measured in old buildings, and there is always the chance that nature's own wrecking crew, rust and decay, already have started the job, increasing its dangers. He cannot destroy carelessly, as materials with salvage value must be handled cautiously.

One of the most difficult feats in the history of wrecking, the experts say, was accomplished in tearing down an old Chicago steel building that had a conical roof, 180 feet from the ground, over an open court. One by one, the curved steel girders were removed until only two, opposite each other, remained. To prevent accidents, derricks were erected on each side of the building and tackle fastened around each support at a point beyond the center, so that the beams would not tip under the weight of a man. Then two skilled wreckers climbed up to the ends of the supports, one on each girder. Working cautiously, they cut away the last remaining rivets so that the two beams swung free at exactly the same time, and the men rode them to the ground without mishap.

Even big pieces of steel must be handled carefully when they have salvage value. In the case of the big Chicago warehouse, the iron sold for $80,000. The contract specified that the lengths must be delivered in good condition, unsprung and not mutilated. To save time in handling, and to protect the pieces, a chute was constructed from the top of the building to the bottom. It was made of beams taken from the floors and, at two places in the descent, other beams were placed as wedges to check the speed of the girders, and they shot like projectiles down the runway, sending out showers of sparks and crashing against a special bulwark at the bottom. When the steel was coming from the higher floors, this bulwark was built up of twelve-by-twelve-inch wooden pieces. Some of the heavier lengths plunged through the backstop like bullets. Steel bulwarks were later used. The beams were picked up by a steam shovel, minus the bucket, and swung into a truck which hauled them away. Columns with rough edges or protruding sides, likely to stick in the chute, were lowered with derricks. The chute not only saved time, but avoided the necessity of hiring structural iron workers at high wages.

The concrete breaker, used for the first time on a job of this kind, shattered the floor directly into the hoppers of the tractors below, when possible, to save extra shoveling. Bits of wooden flooring and other inflammable rubbish were dropped down the smokestack and consumed in the pits below. The fire helped warm the workers as well as solved the rubbish-disposal problem. Bonfires were built next to concrete walls in places to soften



Pulling the Portable Office to a Lower Floor and "Logging" Steel Beams with Caterpillar Tractor to the Chutes Where They Are Sent Crashing Down to Ground Level and Hauled Away

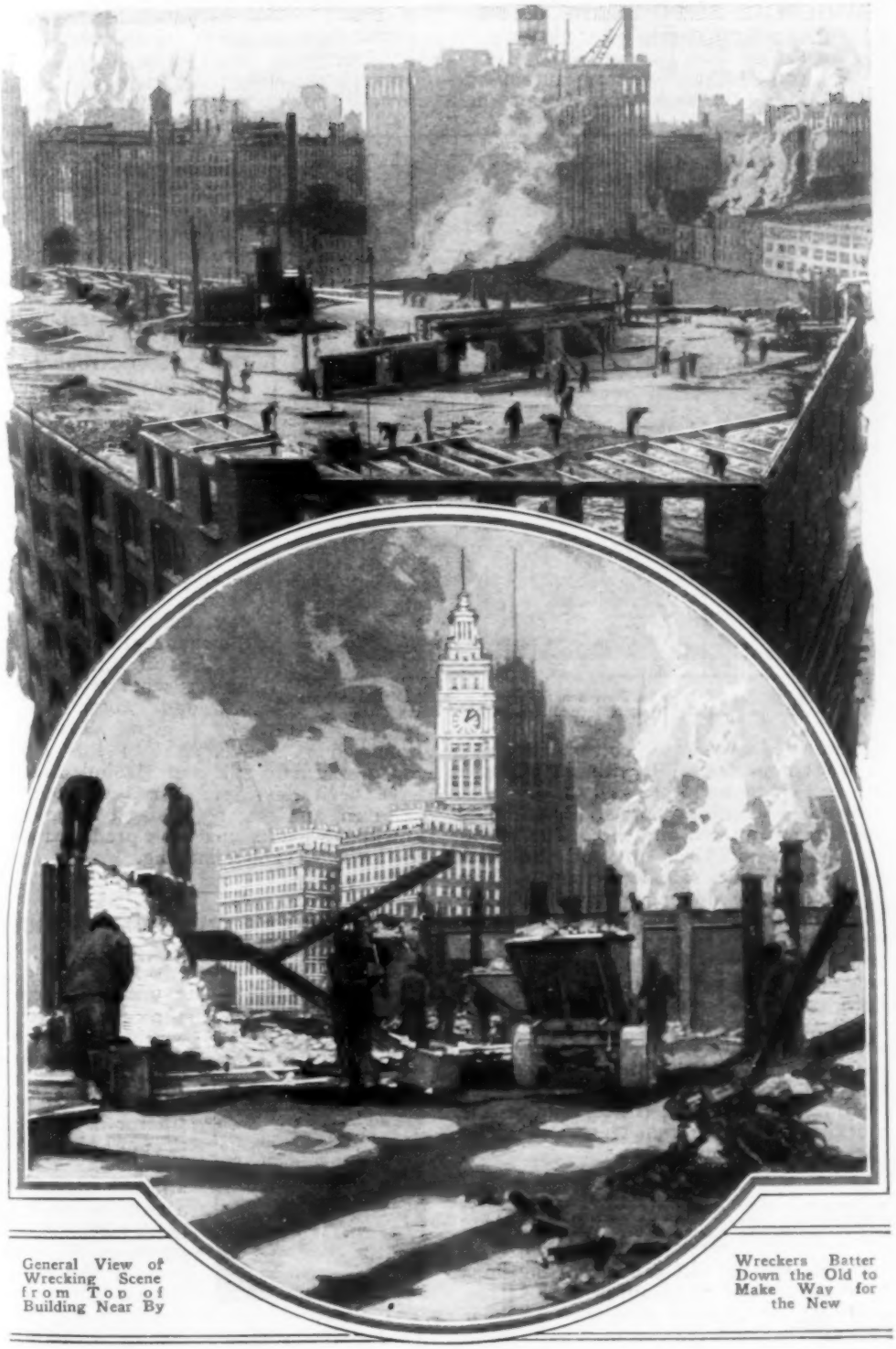
them for the wreckers. Four compressed-air guns operating at eighty and 100 pounds' pressure were employed in demolishing the walls. The compressors and other equipment were taken to the upper floors in the building's freight elevators. Some pieces had to be knocked down and were reassembled. Moving from floor to floor was accomplished by means of a ramp. A portable office, electrically lighted and with telephones, was headquarters for the timekeeper and foreman on each floor. As the wrecking neared the ground, the office was pulled to the next floor by ropes, and put into service again after reconnecting the wiring.

Materials taken from doomed buildings serve many purposes. Steel goes to the mills for resmelting, altering buildings or for shoring in new construction work, depending upon the condition of the beams; junkmen purchase plumbing, machinery, boilers and fixtures; some of the plate glass will reappear as automobile windshields; lead, brass, zinc and other metals are melted up and perhaps used for ammunition or for manufacturing various articles. Lumber that has been only slightly damaged, is kept for scaffolding, shoring and timbering, or for erecting cheap houses. Wrecking a big building usually brings joy to many poor families, for there are almost always loads of kindling wood to be had free. Broken plaster, brick and concrete are saved for filling or for road building. Stone slabs are often worth preserving. Tombstones are carved from granite and marble blocks, while other stonework that escapes damage may be used in mausoleums or apartment houses.

Partly because of the difficulties of the work and the consequent need of greater skill, wages of professional wreckers in most cities have increased within the last few years from a few cents an hour to more than one dollar. New York city's some 300 professional wreckers now command $1.05 an hour, whereas their pay before the World War was less than fifty cents. Only a few of the workers seen on a job are classed as real wreckers. They are the men who mount walls with bar or pick and do the most hazardous parts of the task.

In the eyes of most insurance companies, wrecking, like building, is a hazardous occupation. Some surety concerns charge the contractors more for protection in the event of death or injury of the wrecker than for any other class of labor. In some cases, it amounts to half a dollar for every dollar paid the men in wages. The likelihood of injury with the consequent loss of time, rather than the great probability of fatalities, explains this. Comparatively few deaths occur.

Connecting Hose to a "Gun" for Breaking Down Walls with Compressed Air; Bricks and Concrete Meant to Stand for Decades Crumbles under This Modern Form of Attack



General View of Wrecking Scene from Top of Building Near By

Wreckers Batter Down the Old to Make Way for the New

ADHESIVE AUTO-TRAFFIC SIGNS LAST LONG ON PAVEMENT

To replace hand-painted automobile-traffic signs for pavements, letters on a special kind of durable cotton cloth that is coated on one side with an adhesive are quickly laid and are said to last much longer than ordinary signs. Automobiles running over them and the action of the sun's rays both help to bind the cloth to the pavement. The letters are uniform in size and are shipped with the adhesive sides together, so that they are ready for use simply by pulling them apart. They will stick to cement, brick, cobblestones, macadam, asphalt, wood-block or any hard surface, about the only precaution necessary being to thoroughly clean the surface and have it absolutely dry. Tests have shown that while hand-painted letters will last only four or five weeks, the cloth signs withstood traffic four or five months. The experiment was made at the same intersection.

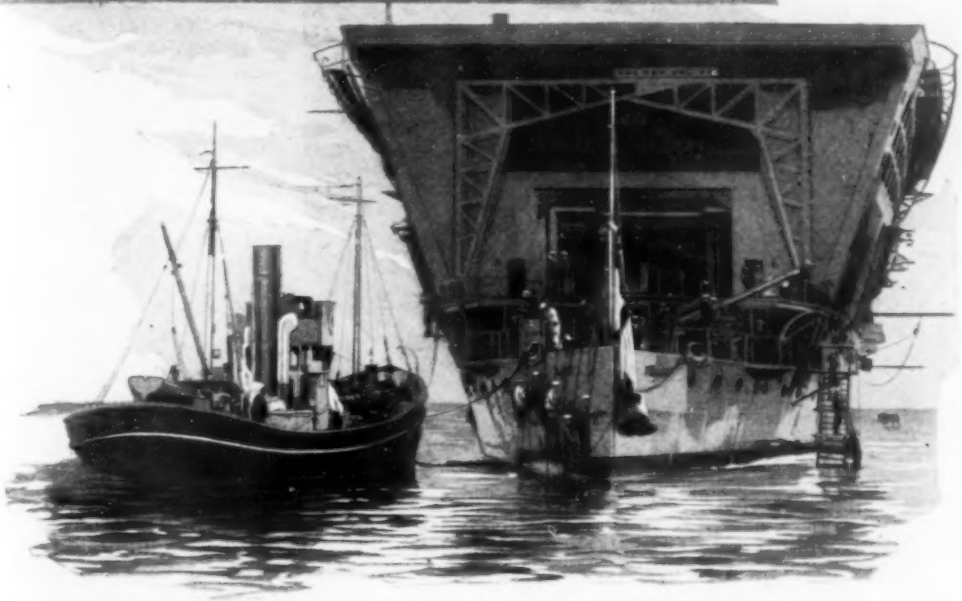
Putting Traffic-Sign Letters on Pavement; They Are on Glued Cloth Squares Which Become Firmly Attached to Surface in Short Time

SOURCE OF SYNTHETIC RUBBER SEEN IN OIL WASTE

In the gummy substance that develops from the oil and clogs automobile valves, scientists see a source of synthetic rubber that can be produced cheaply and in large quantities. The product can be made from a certain class of hydrocarbons which are found in huge quantities in every petroleum refinery. To get rid of these substances, the industry is now wasting approximately 90,000,000 gallons of motor fuel annually, destroying the stuff from which synthetic rubber could be prepared. During the war, Germany produced rubber from the by-products of alcohol distillation, but these materials are no longer available at economical prices, and one of the reasons the synthetic rubber industry has not developed in this country, is that there has not been sufficient investment in the necessary experimental laboratories for the study of petroleum. Scientists point out that, although this country produces about 2,000,000 barrels of crude oil every day, nobody yet knows the chemical constituents of the oil and nobody knows what gasoline is although about thirty per cent of all the oil produced is converted into this form. Since synthetic silk and alcohol already have been developed through scientific research, and better glass and indigo are now being made, success is predicted also for artificial rubber making.

CORK PULLER WITH FLAT HOOK PREVENTS TEARING

Corks are removed without tearing them by means of a puller with a flat hook at the end. The extractor is inserted at one side between the bottle and the cork, and a twist places the hook where it will fit under the bottom of the cork. Then a slow, steady pull will remove the stopper, usually with very little difficulty.



Two Views of the British Airplane Carrier "Furious"; It Is a Seagoing Hangar and Landing Field Combined, with Broad Upper Deck, Shops and Wide Entrance at Stern Guarded by Guns; in Upper Photo, End of Center Line That Divides Flying Deck Is Seen in Front of Pilot's Cabin

BRITISH PLANE-CARRIER SHIP HAS HUGE FLYING DECK

Wide space for airplanes to land and take off, as well as commodious hangars are provided in the plane-carrier ship "Furious," recently added to the British navy. To assist the aviators, the center of the flying deck is plainly marked in broad white lines so that it can be more easily seen from the air and to prevent accidents. Entrance to the stern hangar is wide enough to permit handling large units. Guns are also set here. The ship has all facilities of a land hangar.

STORM-PROOF TELEPHONE LINE TO LINK MID-WEST CITIES

Telephone service between large cities in the middle west will be less hampered, after severe ice and sleet storms, as a result of a special cable line now being constructed between Chicago and St. Louis. It will connect with a similar system already built to New York. Individual wires are sheathed in a protective metal coating, and the cable is strung between poles somewhat shorter than the usual telephone supports and set closer together. At intervals of fifty-five miles "repeater stations," costing from $150,000 to $300,000 each, are erected to preserve the volume of the voice, insuring satisfactory service. Vacuum tubes, similar to those used in radio are important units in these stations, building up the sound so that there is little loss. It is estimated that the Chicago-St. Louis line will represent an investment of nearly $7,000,000 when completed. As an example of how a storm will cripple telephone service, the wind and ice of December 18-19, 1924, did nearly $1,000,000 damage to the lines of one company alone, felling 23,000 poles and putting thousands of wires out of use.

TRIAL SHOTS AT DUMMY MAN IMPROVE POLICEMEN'S AIM

Boston policemen are being trained to cope with bandits by target practice at a life-size silhouette of a man marked to show vulnerable spots and to provide a means for keeping an accurate score of the shots. The target shows the figure as though drawing a revolver from a hip pocket. One of the objectives of the drill is to see if the marksmen can hit certain parts of the figure at will.

Computing the Score of Pistol Fire after Shots at Dummy Target; Figure Is Life-Size and Marked in "Vulnerable" Sections

MILLIONS OF THUNDERSTORMS RECORDED EACH YEAR

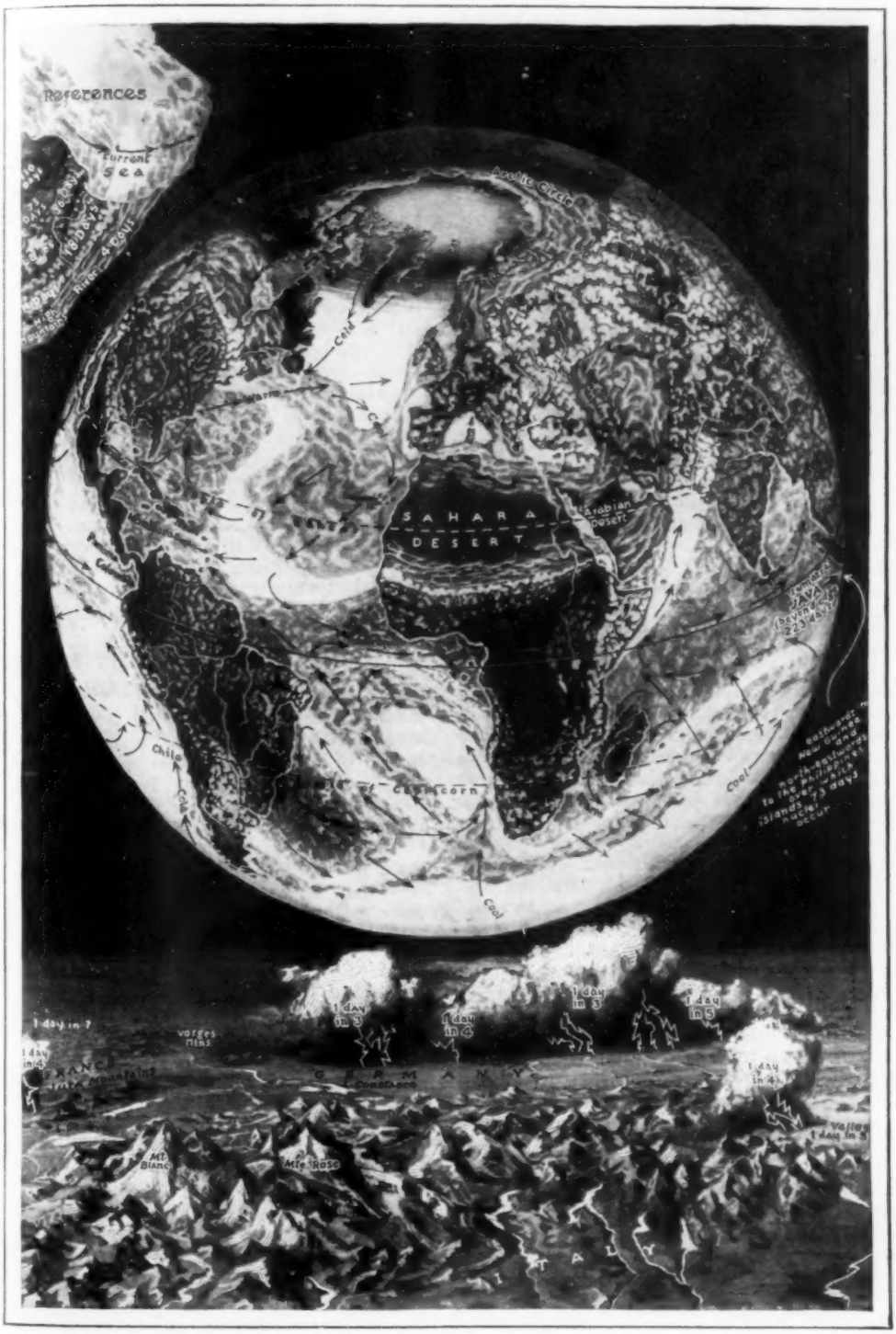
Better than 45,000 thunderstorms each day, or 1,800 an hour, is the record for the entire surface of the earth, according to recent computations based on years of observation at thousands of widely scattered stations. The island of Java is accorded the place of the world's most thundery spot, with no less than 223 storm days each year, while in vast tracts around the poles, a thunderstorm every ten years is an event. The almost rainless Sahara desert and the interior of Australia share this honor with the top and bottom of the earth.

Twenty-year records of the United States weather bureau show that there are few spots in this country where the person afraid of lightning may be reasonably safe from scares throughout the year. Part of the coast region of California, part of the Alaskan coast and a few other sections, however, are fairly free from such disturbances.

The month-by-month charts of thunderstorms for the twenty-year period indicate that the storm areas have certain definite focal centers and follow certain paths as the seasons change. During the months of December, January and February the center of thunderstorm activity is around Vicksburg, Miss., but by February there is a tendency to drift southeastward, with a secondary center developing over Pensacola, Fla. In March the center of activity is still the lower Mississippi valley, with the storm area spreading northeast over the Tennessee and Ohio river valleys. In April, Shreveport, La., is the main center, but the area has spread over most of the northeastern states, as well as west and north. In May, the primary center develops over Tampa, Fla., with a strong secondary over the lower plains states, great activity prevailing over the entire east, except in the Canadian border states and New England.

In June the area spreads northward and covers all of the states east of the Rockies, while in the following month the activity in the Rockies increases, with a strong secondary center over Sante Fe, N. M. The latter weakens in August, while the Tampa and Sante Fe centers persist into September, and in October the first shifts south to Key West and the second east toward the plains states. During November the storm area retreats to the winter center.

In foreign lands, central Africa rates next to Java in thunderstorm frequency, with 150 days a year; southern Mexico has 142; Panama 136; central Brazil 105, and Madagascar ninety-five. Ocean currents, prevailing winds, and mountain ranges have a marked effect on the number of storms. The cold current sweeping up the coast of Chile keeps the country free from storms, while the warm Gulf stream sweeps a long trail of gales and storms across the North Atlantic.



Copyright, S. W. Clatworthy

Drawing Shows How Thunderstorms Are Distributed over the Globe; the References in the Upper-Left Corner Indicate the Frequency, in Number of Days, as Shown by Lines on the Globe

HOME TRAINER FOR GOLFERS SHOWS STROKE ERRORS

With a compact home-training outfit, golfers not only receive valuable practice

Golf Ball Is Attached to Cord Connected with Indicators, Which Register Errors in Stroke

for the course, but learn just what is wrong with their strokes, whether they top or slice the ball, and the distance the sphere would have gone in actual play is also registered. The instrument is a platform arrangement, little more than two feet long, about nine inches wide and two and one-half inches high. At one end, a golf ball is attached to a cord which is anchored to the board and the indicating mechanism. This consists of a distance gauge to show the force of the stroke, a register that tells if the ball deviates from a straight line and two indicators which mark, with telltale arrows, if the sphere is topped, sliced or both. After a stroke, the indicators are instantly set back to a neutral position simply by stepping upon the button to which the ball is attached. The trainer can be used indoors or out.

PENCIL SPOT WEIGHED BY BALANCE SCALE

Among the marvelous instruments used by scientists is a balance scale so delicately adjusted that it will tip under the weight of the few particles of lead deposited upon a piece of paper in making a period with a pencil. It weighs articles that are never associated with weight at all except in scientific experiments. Another device, which has a practical service for thousands of persons, is called a spherometer, a gauge that registers variations as slight as one-hundred-thousandth part of an inch in the curvature of lenses for spectacles. If the housewife had a cutting machine like that used in examining blood corpuscles, she could prepare a sandwich ten feet long and eight feet wide from a piece of cheese only an inch in each direction, for it shaves extremely thin slices and can cut a blood corpuscle into three parts. The thickness of these parings, of hairs or of cigaret papers can be measured, if desired, in another gauge which registers differences as small as one-two-hundred-thousandth part of an inch. Time-measuring instruments are now so exact that after a journey around the world, the mariner can detect variations of not more than a second a week and sometimes less. With a cup micrometer, changing positions in seams of coal and similar formations that move only an inch in 100 years, can be forecast.

HOUSE BUILT WITHOUT NAILS HELD BY WOODEN SCREWS

Held together entirely by wooden screws instead of nails, a large frame house of elaborate pattern is one of the sights of Atlantic City. It is the Michigan State house, built for the Philadelphia centennial fifty years ago, and was moved to its present location after the fair. Despite its age, it has not been remodeled and is in an excellent state of preservation.

Fifty Years Old, but Still Substantial, Although There Is Not a Single Nail in It; Frame House Held Together with Wooden Screws

Hunting Seals on Ice Floes

By HAROLD T. WILKINS

SMASHING and grinding its way along a narrow lane of water, fissured in the ice floes, creeps a steamship whose rigging is covered with frost and icicles. The trailing smoke from its stack and the blunt-nosed hull are sharply outlined against the fields of blinding white. For days, the steamship has been nosing its way into the frozen North. Somewhere in these vast ice floes are hidden the great herds of "harps" (seals). The "scunner" (lookout man) has been vainly seeking these animals ever since the ship crept through the broken ice in St. John's harbor and headed into the Atlantic.

"White coats to stabburd," shouts the lookout as he hears a wailing which betokens that somewhere near lies a "patch" of seals, perhaps 50,000 in number, and, crying for their mothers, the white-coat baby seals, the special object of the steamer's quest.

From the deck soars a small airplane which is soon lost to view. Forty minutes pass, and then the ship hears the humming of the returning craft. The pilot announces that he has spotted a patch of harps, 80,000 strong, on the ice about five miles away.

The captain shouts and the engine-room telegraph rings to go astern. A lane has to be opened through the ice encompassing the ship.

"Astern it is!" Round spins the wheel, and the three helmsmen hold on to the spokes, since, if the rudder hits an ice pan and wrenches the wheel out of their hands, the whirling spokes will easily break their arms. The steamer backs to gather way for a charge on the floes. The telegraph rings full speed ahead, and the iron-sheathed bow drives crashing onto the floes.

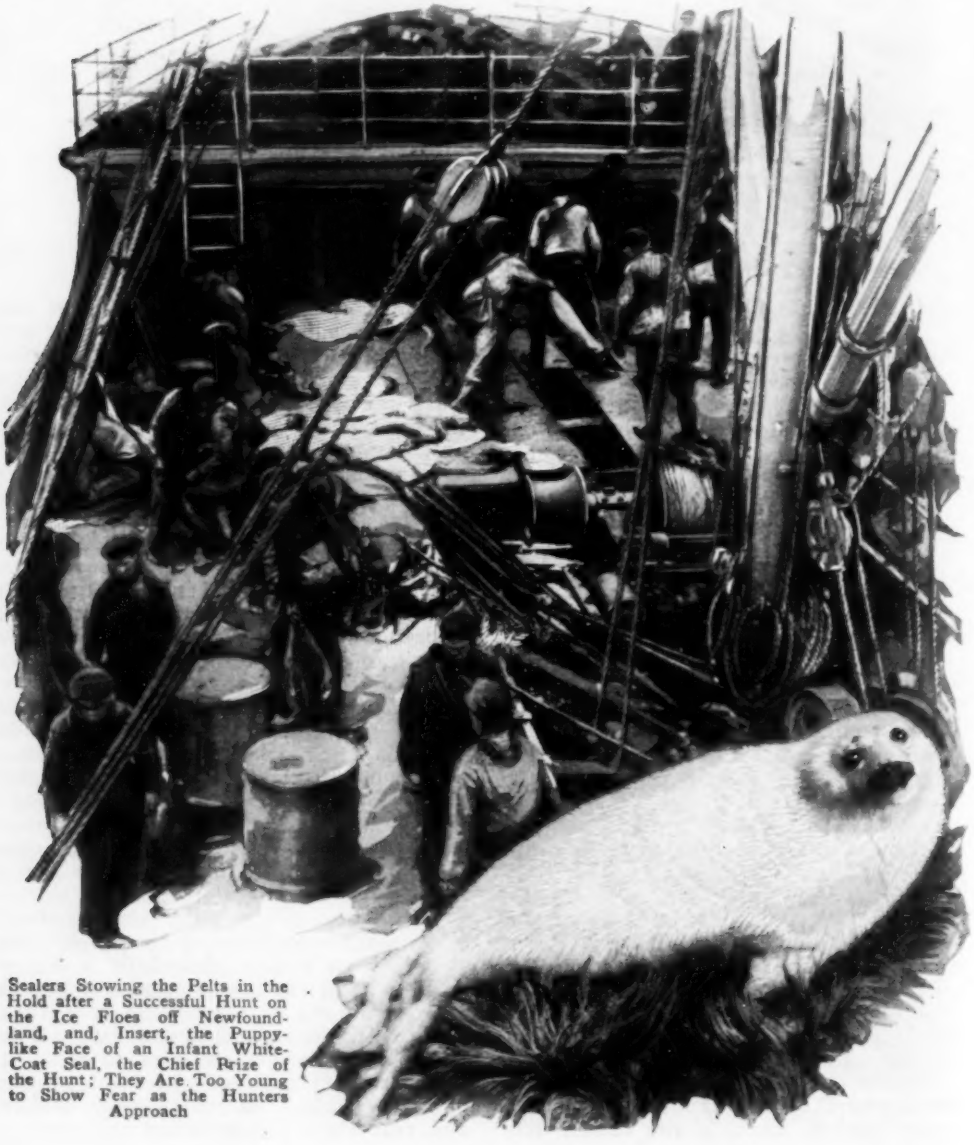
The ice, however, is too thick to be battered, and the bombers fix blasting charges and fuses to long poles, and drive holes through the ice by the side of the ship. A red-hot iron bar is touched to the end of the fuses, and the bomb is caught up and thrust far under the ice. Blocks of ice shoot up as high as the masthead, and the way is once more clear for the ship.

Half an hour later, the scunner in the crow's nest sights a herd of thousands of seals lying asleep on the ice. Men swarm down ladders and ropes from the decks onto the ice with gaffs, "sculping" knives and rifles. Behind each gunner walks an assistant with a bag of ammunition. Some carry torches, others bread in case they lose sight of the ship in the mist. They crawl over an ice field which heaves and falls as though it were the deck of a ship rocked by a heavy swell. Then the sharpshooters take up position behind hummocks. A shot rings out, and an old sentinel seal falls. The firing becomes general and there is a panic-stricken rush of the herd to the "bobbing holes," in which they shelter and rear their young below the surface

of the floes. If the bobbing holes have frozen over, the seals race to a weak spot on the ice which their combined weight crushes, letting them through to deep water and safety.

Next, men with sheath knives in their belts and armed with six-foot-long gaffs attack the small seals. Out come the knives, and the fat or blubber of the young white coats is cut off. It is rolled over, its pelt skillfully and neatly removed, and its "flippers," or fore paws, cut off to be later turned into an appetizing dish. The pelts, or "sculps," are piled up in a pan, and each pan of skins is buoyed with a red flag in the daytime, or a torch at night. Many miles of the ice floes are covered by the sealers after jumping off from their ship. A torch-light pan may be too far from the ship for its load to be hauled back, and the steamer will have to force a laborious passage through the ice to reach the pan and collect the sculps.

The men who carry the ammunition bags cut off the tails of the seals to tally up the kill. Then they tie the pelts to a line, and tow them over the icy trail to-



Sealers Stowing the Pelts in the Hold after a Successful Hunt on the Ice Floes off Newfoundland, and, Insert, the Puppy-like Face of an Infant White-Coat Seal, the Chief Prize of the Hunt; They Are Too Young to Show Fear as the Hunters Approach

Sealing Steamers in the Ice Fields with Lookouts on the Yards; Right, Mother Seals and Their Pups at the Pribilof Islands

ward the ship, taking care not to damage the skins, since any tears lessen their value. On board the ship, the winches are hauling the sculps and fat on deck from the ice below. The blubber is run into steaming tanks, and the sculps are stowed in the hold. Now the pans of pelts and fat are safely in the hold and the tanks. "Sparks," from the radio cabin, has flashed to the land station in code the tale of the kill for the benefit of the waiting owners and the relatives and friends of the captain and crew. Once more, it is full speed ahead.

The Newfoundland sealer, it is obvious, must be able to endure his months of hardship. Once on the floes, the sealer, at peril of his life, must never forget that the ice is ever on the move, drifted along on the polar current flowing southward to the Grand Banks. At any moment, an arctic blizzard may cut him off from his ship. When the barometer is low or falling, the man who gets out of sight and is caught by the fog creeping up over the floes, may easily freeze to death.

The ship is always on the watch for

fog, and, at the first sign, the siren shrieks and a flag is run up to the truck to warn the men on the ice. Torches are lit on deck and a light burns on the masthead when the sealers are delayed or lost on the ice fields. Indeed, all night long, whatever the weather, lights burn in the cabin and forecastle, since, at any moment, gales may spring up and the ship be pinched in a jam of ice blocks. One steamer, caught between two enormous pans of ice, had its bottom cut out, and when the ice opened up it sank, the crew being rescued by other steamers of the sealing fleet. Another wooden steamer was nipped amidships and so badly squeezed that its rigging became quite slack. As soon as the pressure was eased, the ship resumed its former shape and girth. A few years back, seventy-seven sealers perished in a blizzard on the ice not very far from their ship, which they were utterly unable to reach in the blinding storm. Again, an ice hummock may shift under a man as he jumps across the floes and fling him into the icy water. Snow blindness is not uncommon, and goggles have to be worn to shield the eyes from the glare.

Bursting boilers are another ever-present danger. Twenty men were instantly killed when the S.S. "Tigress'" boilers blew up. The terrific strain of forcing a way through the ice may open the ship's seams or burst its steam pipes; or the cargo may shift under the sudden impact of a hurricane, as in the case of a loaded Newfoundland steamer which went down with 173 men and a full load of seals. Added to these risks, propellers may be carried away by the ice or the rudder smashed, leaving the vessel helpless.

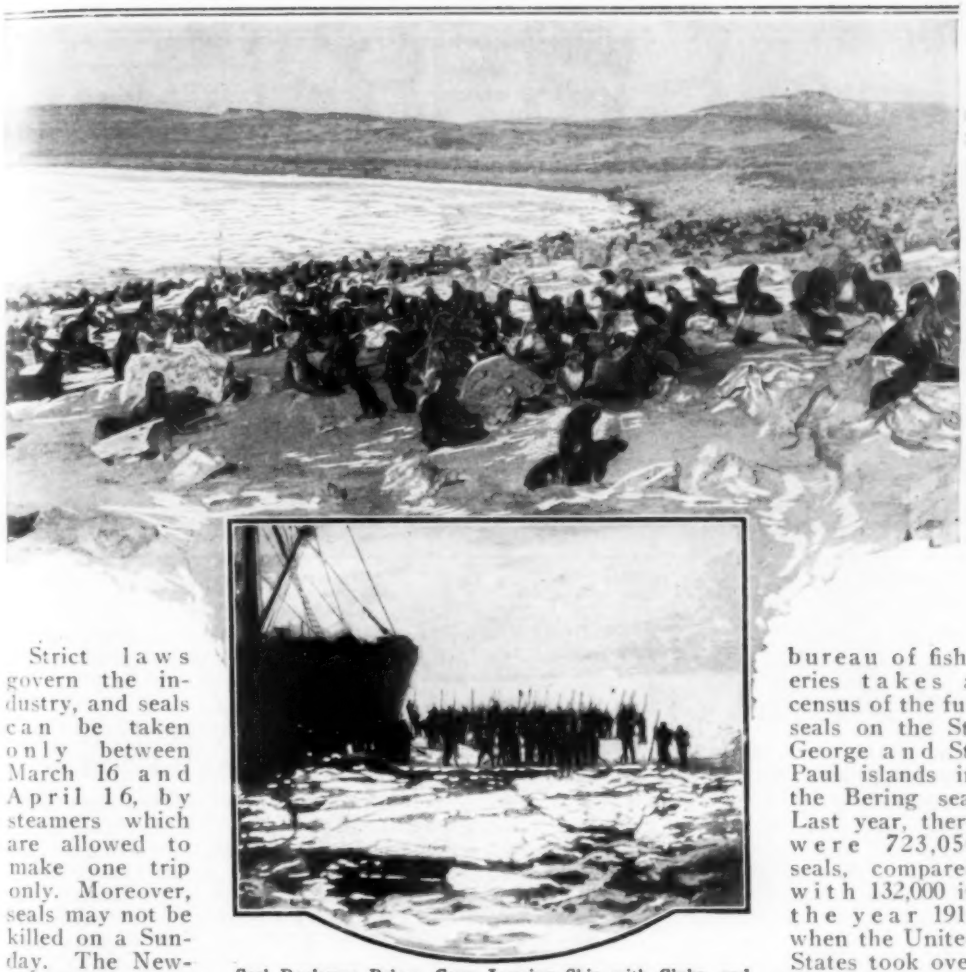
After all these hardships and dangers have been passed comes the division of the spoils when the steamship returns to port. The owner takes two-thirds of the catch, and the crew share the remaining one third. The earnings of a member of the crew seem to average $60 for four weeks' work; in a bumper year, he may get as much as $150 for the season. The record remuneration of a sealing-steamer captain in Newfoundland, for twenty days' work, is $5,433, but this amount is exceptional. "A man will go for seals," they say, "where gold won't draw him." Seal oil, today, brings about $500 a ton, and seal sculps about $4 each.

Iron-clad ships break their way through the ice better than wooden vessels, and at the beginning of the European war, Newfoundland possessed a powerful fleet of iron steamers. All of them, however, were sold, and, at the moment, all the island's ships engaged in the sealing industry are wooden boats. Last year, eight of these wooden steamships landed something like 130,000 seals in Newfoundland.

On shore at St. John's, the blubber of the seals is run into tanks and refined in steam vats. It is finally bleached by the sun and converted into a pure, sweet, colorless oil which is used as a safe illuminant in mines, an ingredient in olive-oil soap, a lubricating oil, in margarine and in perfumes. The sculps are steeped in brine, and sent to England where they are made into high-grade leather used in the manufacture of dainty handbags.

Pictures by courtesy of the High Commissioner for Newfoundland

Dragging the Sculps, or Seal Pelts, over the Ice to the Sealing Steamer; the Skinning Is Done on the Floating Floes So Each Man Can Take Back a Large Number of Pelts



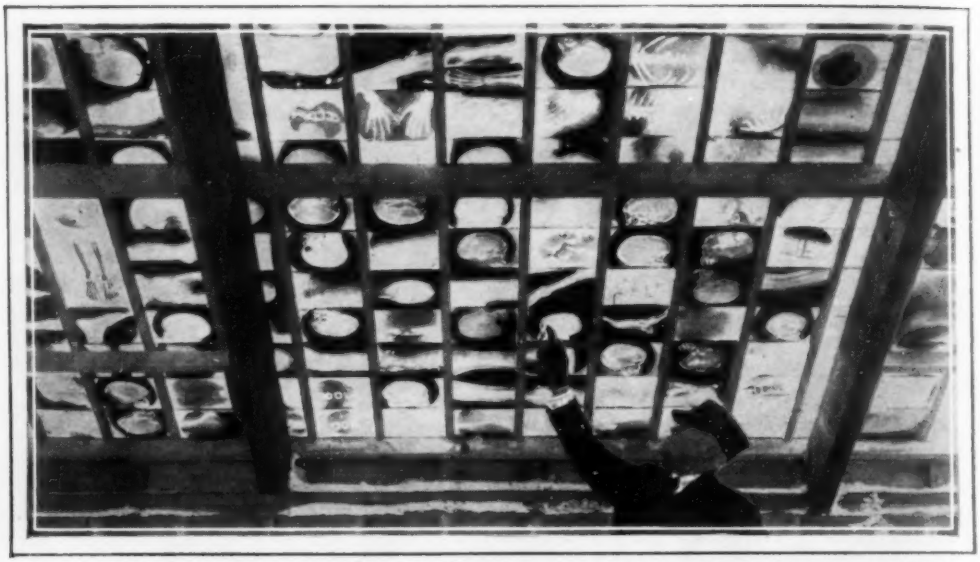
Seal Rookery; Below, Crew Leaving Ship with Clubs, and Flag-Tipped Lances to Mark the Kill

Strict laws govern the industry, and seals can be taken only between March 16 and April 16, by steamers which are allowed to make one trip only. Moreover, seals may not be killed on a Sunday. The Newfoundland seal is a hair seal, quite distinct from the fur seal of the Pribilof islands. Its home is in the Arctic circle, though it spends only three months of the year there and is migrating the rest of the time. The seals move south in a great arc after the breeding season, fattening on candlefish as they go. Some of them wander as far south as California, over 1,200 miles away, to return to the rookeries for the next pupping season. Not only adults but the immature animals too do this. The only place where the fur-seal herd ever comes ashore is on the Pribilof islands.

Uncle Sam's seals on these islands form about ninety per cent of the world's fur seals. The management of these herds is entirely in the hands of the government, a monopoly made necessary to prevent their extinction. Every year, the bureau of fisheries takes a census of the fur seals on the St. George and St. Paul islands in the Bering sea. Last year, there were 723,050 seals, compared with 132,000 in the year 1910 when the United States took over control. The pelts of the Alaskan fur seals are cured by steeping in brine, after which they are packed in barrels and shipped to the States, where they are sold at public auction.

POLICE WEAR ROLLER SKATES TO COVER LONGER BEATS

Roller skates and the Versailles treaty seem to have no connection but they have. The agreement, among many other provisions, limited the number of men on German police forces. To enable the reduced corps to cover their territory patrolmen in Dresden are being taught how to use rubber-tired roller skates. An expert has been hired to instruct them and classes are held twice a week. Target practice while skating has also been attempted during the lessons.



Instead of Being Sent to the Scrap Heap, Old X-Ray Plates Were Fashioned into Serviceable Roof for Hothouse; Inspecting Them Gives Workers Diversion from Toil

OLD X-RAY PLATES FOR ROOF COVER GREENHOUSE

Prisoners working in the greenhouse at the penitentiary on Deer Island, Boston, Mass., if so disposed, can study interesting revelations of the human anatomy simply by glancing upward at the roof, for the covering is composed of discarded X-ray plates donated by the city hospital of Boston. Skulls, arms, ribs, hands and fractured bones are included in the unusual canopy.

SOLID-RUBBER TIRE TRIMMER SAVES TIME AND EXPENSE

Solid-rubber tires can be trued up in about five minutes each and at a cost of not more than fifty cents, it is said, with a simple frame-and-shaft apparatus now on the market. It has a self-centering set of cones which quickly adjust the wheel to the correct center after it is slipped on the shaft, and a turn of a handle on the other end of the bar revolves the tire so that rough and uneven spots can be quickly trimmed off with a cutting tool held against the outer edge. This arrangement makes possible the use of solid tires until they are practically worn out.

Trimming Up a Solid Rubber Tire in Frame Which Accurately Centers the Wheel

PUEBLO BUILT BY INDIANS HAD TWO THOUSAND ROOMS

While modern city dwellers have been boasting about their mammoth hotels and apartment houses, scientists have been digging among some old ruins in New Mexico and have discovered that an ancient Indian pueblo, near Taos, contained from 1,500 to 2,000 rooms and probably housed 2,500 persons. This gigantic building was a whole city in itself and was probably the largest settlement in North America when Columbus landed. According to Dr. Alfred Vincent Kidder, of Harvard university, who has spent ten years in archaeological research in this region, the city of Pecos was founded about 800 A. D. Conveniently constructed on the edge of a cliff, it was protected from attack, and inhabitants could throw their rubbish, household sweepings and broken implements into the ravine. In the course of the cen-

turies, they piled up one of the biggest garbage mounds known to man. Unwittingly they were giving the scholars a fairly accurate record of their doings by this system of refuse disposal, for the big mound, stratified like a huge layer cake, tells the story of their arts, industries, language and customs from the time the city was first settled until it was abandoned 150 years ago. Over 10,000 specimens have been recovered from the heap and arranged to form a 1,000-year diary of the Pueblo dwellers.

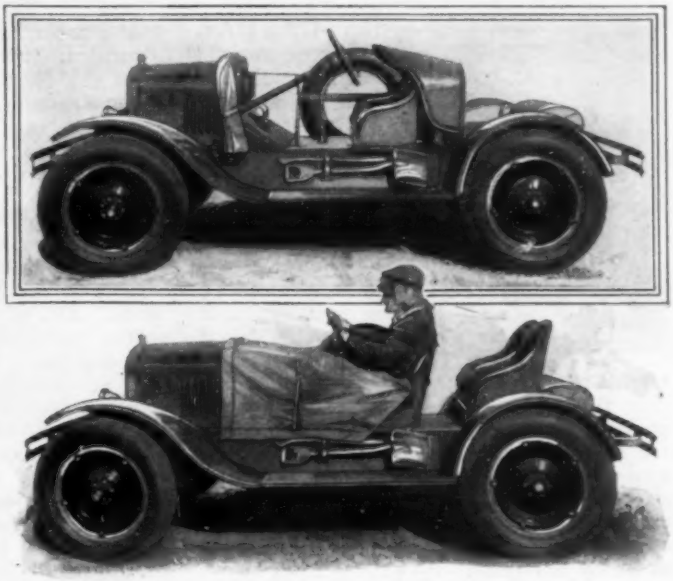
The city itself was constructed in the form of a square with a large court or yard in the middle. The houses were all alike, four stories high, with ground-level rooms for storage of corn and other foodstuffs, and upper rooms for living purposes. The city was without streets. An underground council chamber was hollowed out below the walls of stone and mud, which were constructed by the women. The men cut and set the roof beams. The women owned the houses. The inhabitants supported themselves by growing corn, beans and squashes. They made fine pottery, raised cotton and kept turkeys. It is believed that the end of the city came at about the time of the American revolutionary war.

GUM CLEANS TYPEWRITER TYPE WALL PAPER AND GLOVES

Dirt and ink are removed from typewriter type by a soft gum that is warmed by the hands and pressed down on the characters. Foreign matter is said to adhere to it readily and it can be used repeatedly. It also serves as art gum for removing marks from drawings, cleaning wall paper, kid gloves, collars and other articles.

CROSS-COUNTRY ARMY AUTO TRAVELS ROUGH GROUND

If you should see a small automobile, without a windshield and equipped with four bucket seats, speeding along the highway, do not hastily assume that it is a 1926 sports model. It is the latest army cross-country car developed to meet the requirements formerly imposed on the horse or small tractor in transporting army personnel and equipment. Officials declare that it achieves the "motorization of the individual man." Weighing only 1,150 pounds, equipped with steel fenders both in front and rear and with thirty-by-five-inch tires, it can quickly be converted into a truck simply by removing the two rear seats and substituting a special box, which is intended to hold ammunition or small articles. Tests have showed that it is capable of going over rough ground even when loaded to capacity. In addition to other tools, a shovel and an ax are strapped to one side.



Motor Horse for the Army Man; Upper Photograph Shows How Seats Tip Forward for Removal; Tarpaulin Is Only Protection for Driver

¶According to statistics prepared by Lloyd's, United States ranked sixth among the world's shipbuilders last year. Total tonnage now under construction here is 105,000; Great Britain is first with 895,000 tons, Italy second with 309,000, Germany third with 234,000, France fourth with 167,000, and Holland fifth with 108,000 tons.

He Has a Genius for Germs

Dr. William H. Park Sees Time When Science Will Abolish Communicable Ills of Mankind

By EARL CHAPIN MAY

THE CASUAL observer would hardly pick out Dr. William H. Park as a fighting man. He is not quite five and a half feet in height and weighs less than 160 pounds. His eyes twinkle brightly behind spectacles and his face often is wreathed in smiles. But he is a fighter just the same. He fights with and for germs. For thirty-three years he has led the battle against communicable diseases in America, because he likes the game and rejoices in the results. He introduced us to diphtheria anti-toxin. And he discovered his genius for germs almost by accident.

It was in 1892, shortly after he had returned from a year in European hospitals, that Dr. Park suggested to Dr. T. Mitchell Prudden, then of Columbia university, that diphtheria should be diagnosed by germ cultures. Up to that time it was our custom to diagnose communicable throat diseases by sight. A physician would gazé down an inflamed throat and pronounce the disease quinsy, scarlet fever or diphtheria, according to his best judgment. Diphtheria cases were frequently assigned to the same wards as simple tonsilitis cases, with disastrous results. Dr. Park changed all that. He introduced the swab, the bacteriological test and the microscope slide. Tonsilitis and scarlet-fever germs grow in chains like a string of pearls. Diphtheria germs are long and clubbed. There is as much difference between them, under the microscope, as between cinnamon sticks and blueberries. It is a relatively simple matter to discover a diphtheria case now.

"We know from long years of experience," he declares, "that where smallpox germs have been consistently combated by the use of vaccine virus, smallpox has

School and Hospital Combined; Older Children, with Nurse in Attendance, Are Encouraged to Continue Their Lessons While Getting Well, and Are Given Valuable Knowledge to Help Them Guard Their Health

Story-Telling Time in Willard Parker Hospital; These Children Breathe through Silver Tubes, Having Suffered Throat Strictures as a Result of Diphtheria; a Nurse Keeps Constant Watch of Them

almost disappeared. But we also know that smallpox is rampant in communities where there is effective opposition to preventive measures against it. The number and fatality of smallpox cases have increased nationally each year for the past three years, because in many states preventive measures have not been adequately enforced.

"Where chlorine is used in drinking water, typhoid fever is a rarity. Once upon a time it was a scourge," says Dr. Park. "The World War proved that inoculation against typhoid largely eliminates that disease even when drinking water is contaminated. The world has been virtually freed from yellow fever by cleaning up the breeding places of fever-carrying mosquitoes. Typhus has been banished from our midst by insistence on cleanliness. Cholera has been eliminated in much the same way.

"Diphtheria still causes more deaths among children than any other contagious disease. One of every fifteen American children may be expected to have diphtheria before he reaches the age of ten, although I introduced diphtheria antitoxin—developed in horses and stored in their serum—to the United States in 1894. But diphtheria will cease to be a national menace if we will adopt preventive measures—if we will make use of our knowledge.

"Last spring, at the 111th meeting of the Medical society of New York state, announcement was made that Drs. George F. and Gladys Dick had perfected a toxin test by which those not naturally immune from scarlet fever could be detected and given immunizing treatment. The Dicks and Dr. A. R. Dochez perfected a scarlet-fever anti-toxin last spring, in the fight against pneumonia, Dr. Lloyd G. Felton, of the Harvard medical school, announced the isolation of a white crystalline substance from anti-pneumonic horse serum, which can be administered without causing serum sickness, and Dr. Banghof of the Health department laboratories is helping him perfect it. We believe this treatment will save one-third of the deaths from acute pneumonia, if used before or soon after the symptoms develop. All of these products are now available without charge for general use to the people of New York city.

"Measles we have nearly always with us, during infancy at least. Ninety per cent of our children have measles. Specialists are combating measles with serum from adults who have been mildly attacked. But in spite of all these applied discoveries by which science fights germs with germs, nearly fifty per cent of our national mortality is caused by communicable diseases due directly to germs.

"Virtually no children will be attacked by diphtheria if they are given diphtheria toxin-anti-toxin while they are well. And virtually all those attacked will suffer no serious consequences if they are treated with anti-toxin in the early stages of the disease. We have proved that in New York, especially since we have been using the Schick test and the immunizing injections among our public-school children. Every parent should be familiar with the Schick test.

"Dr. Bela Schick, formerly of Vienna but now of New York city, discovered, in 1913, that if a very small dose of diphtheria toxin is injected into the skin at the wrist, a red spot, about the size of a dime, will appear in a day or so on the tested one's skin—unless he is naturally immune from diphtheria. If he is naturally immune there will be no red spot. This test, known as the 'Schick test,' limits the injections of toxin-anti-toxin to those who are not immune. Experience proves that injections of toxin-anti-toxin give protection in a great measure for seven years.

"Through study of thousands of cases we learned that while most city babies are born immune because their mothers are immune, and only fifteen per cent of babies under three months are liable to diphtheria, this percentage increases to thirty per cent at six months, and rises to sixty per cent between one and three years and then decreases to twenty per cent at ten years, and to twelve per cent at twenty years and older. So we decided on a primary campaign for eradication of diphtheria in America among children one to three years old, with a secondary one for children from three to ten.

"We began our secondary campaign first in the public schools of New York city, during 1917. Physicians and their assistants from the city laboratory gave the Schick test to public-school children. Where the test showed liability to diphtheria, three injections of toxin-anti-toxin were given. Then the seventy New York city baby-health stations began the secondary campaign by advising mothers to protect their young children with toxin-anti-toxin—if the Schick test showed they were not immune—when they reached the age of six months.

"The results of these extended campaigns are shown by statistics. In 1917, there were 1,158 deaths from diphtheria in greater New York. In 1923, in the larger city, there were only 547. Up to date more than 1,000,000 injections of toxin-anti-toxin have been given in New York city without one serious accident or resultant case of illness. Other cities and towns are following New York's example, some slowly, some under pressure of local epidemics, and still others more actively than in New York.

"Curiously enough, country children are more susceptible to diphtheria than city children. But in most states diphtheria toxin-anti-toxin and diphtheria anti-toxin are distributed without cost to the consumers. Within ten years diphtheria may be as rare as smallpox is where vaccination is generally practiced.

"Ignorance, carelessness and apathy are responsible for most of the sickness and mortality. When sickness seems remote we are not interested in insurance. When it comes home to us, it may be too late to battle with it. Hence, ignorance, carelessness and apathy are our arch enemies. In this fight we must use our common sense. We must learn that the body naturally sets up opposition to all bad germs.

Youngsters Lined Up for Preventive Inoculation against Diphtheria; One of Every Fifteen American Children May Be Expected to Have the Disease Before He Is Ten Years Old

Diphtheria Anti-Toxin Saved These Children from Death, but It Was Administered Too Late to Avoid Sickness and Suffering; Timely Preventive Measures Stop the Disease in Its Early Stages

"Many years ago I knew a girl who showed symptoms of tuberculosis. Had she been given only scientific examination, she would have been officially listed as a prospective consumptive and would have suffered, mentally at least, from that fact. But her physician, mixing good sense with science, prescribed personal hygiene, open air, much sleep and ample meals. The patient is alive and almost well today. She does not know she might have been listed as a 'lunger'."

Dr. Park led me through a room lined with bottles containing billions of quintillions of germs used in combating tuberculosis, scarlet fever, pneumonia, typhoid and diphtheria. He took up one huge bottle, half filled with a reddish liquid, upon the surface of which was what looked like a cream-colored frosting.

"Germs," he stated, squinting at the bottle. "Aren't they pretty? Billions of them, each with its mission in life!"

I enticed him into a hallway, away from the fascinating germs. I knew that Dr. Park is one of the very few American medical men who have been elected to the French Academy of medicine and that in many other ways he is pre-eminent in his branch of the profession.

"Where you and your kind have had a free hand, you have about eliminated yellow fever, bubonic plague, smallpox, typhoid fever, typhus and cholera, from the list of mortal ills," I suggested. "Isn't it conceivable that some day you may rid our country of pneumonia, tuberculosis, diphtheria, scarlet fever and all other communicable diseases; in other words, that all the bad germs will disappear?"

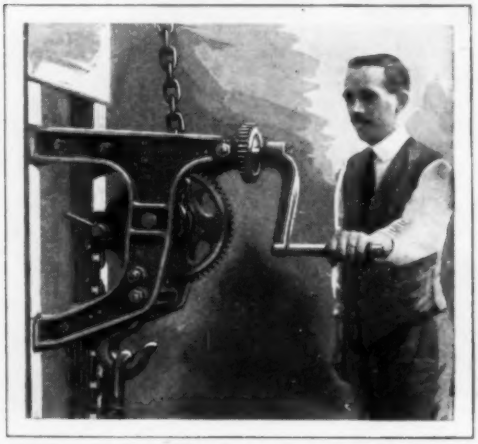
"We can reach such a millennium, I believe," the germ specialist replied, "but—and this is what I am driving at—we certainly will not reach it until we use the knowledge science gives us. Let us all learn more about germs and act upon that knowledge."

CORN SUGAR IMPROVES CANDIES AND PRESERVES FLAVORS

Although corn sugar is not as sweet as the cane product, it is a desirable substitute in the preparation of jams and jellies, according to chemists at the University of Illinois, as it preserves natural flavors, produces a smooth texture in ice creams and candies, and gives doughnuts and waffles a beautiful brown. The sugar, they say, should not be confused with corn sirup or commercial glucose, which is prepared by treating corn starch with acid and heating it under pressure. Corn sugar is a crystalline product with a high degree of purity, manufactured under methods developed within the last few years. The processes resemble those used in the making of cane and beet sugars. Besides helping to retain the original flavor of fruits, corn sugar has the same preserving power as cane sugar, the chemists declare.

PORTABLE WINCH FOR SHOPS HAS VARIABLE SPEEDS

To be used either vertically or horizontally, a portable winch that does the work of a crane, can be moved by one man and



Portable Winch Adjusted for Vertical Lift; It Has Variable Speeds for Different Loads

is easily set up almost anywhere. For weights below 1,100 and 770 pounds, the speed of lifting can be doubled or trebled respectively.

GOING BAREHEADED FAVORED AS REMEDY FOR BALDNESS

If climatic conditions permit, going bareheaded is a step in the right direction to prevent baldness, in the opinion of an eastern physician. It removes one of the contributing causes to loss of hair, a too tight head covering, and also permits the scalp to receive the stimulation of the sun's rays. It has been estimated that, normally, a person loses about forty hairs each day, but the number is said to be less important than their quality. If one-third or more of the hairs from the combings of three consecutive days are less than six inches long, in the case of a woman who has not bobbed her hair, it indicates that there is a scalp disease needing medical attention. Men, or women with bobs, can determine the difference in the hairs by examining the ends. Those that show no traces of the scissors should not exceed one-fifth or one-fourth of the total hairs of four-inch length lost in three days, the doctor declares.

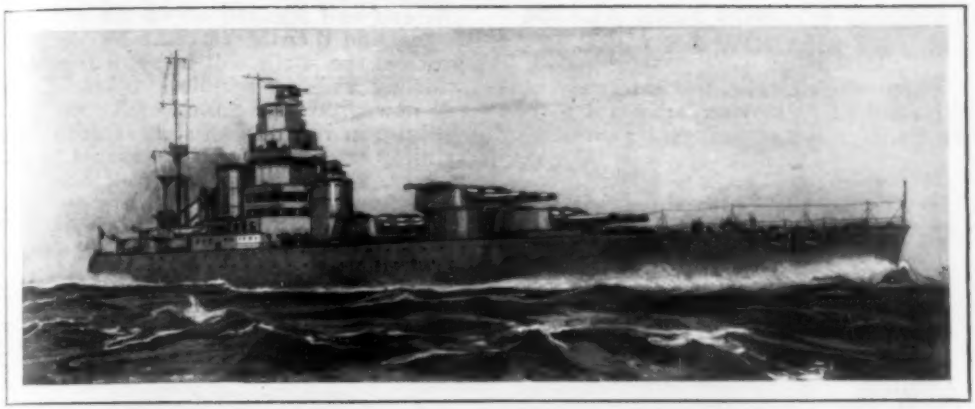
FOREST FIRE DISCLOSES OIL IN SHALE DEPOSITS

Although it destroyed considerable timber, a forest fire in the Santa Barbara reserve recently proved a blessing in disguise for it ignited a formation of oil-shale rocks, exposing a deposit that had only been casually reported by rangers and hunters. Columns of dense black smoke informed observers that something beside the trees was burning. Examination showed that the fire had spread to the oily rock, and as the loose top shale slipped down the slopes, fresh layers were exposed so that the fire burned for a considerable time. Geologists believe that reservoirs of oil may be found underlying the rock formation.

MODEL PALACE ON WORLD TOUR BUILT IN TWENTY-TWO YEARS

What is considered one of the finest examples of model making is a miniature palace constructed by Sir Neville Wilkinson of England. He spent some twenty-two years in its making. It represents the royal residence of Titania, queen of the fairies in "A Midsummer Night's Dream." Elaborate carvings, inlaid work and tiny decorations are features of the palace, which will be shown at the sesquicentennial exhibition in Philadelphia and will then go on a tour around the world.

One of the Rooms of the Model Palace Which Took Twenty-Two Years to Build; It Will Be Taken on World Tour



© The Graphic
Drawing of Great Britain's Latest Capital Warship, the "Rodney"; Three Triple Forward Gun Turrets, the Single Center Tower and Tripod Mast Are Distinguishing Features of the Huge Fighter

BIG BATTLESHIP FOR BRITAIN CARRIES SINGLE TOWER

Has the ultimate in battleships been attained? International treaties, limiting armaments, will at least curb numbers of vessels, and some authorities think that the "Rodney," recently launched in Great Britain, may be the "last of the capital ships as now known, to be built for the British navy." The warship has a displacement of 35,000 tons, carries an armament of nine sixteen-inch guns in three triple turrets placed forward, six six-inch guns in turrets on each side aft, and numerous anti-aircraft weapons. Because of this arrangement, it has been possible to group and heavily armor the magazines while the machinery and boilers have been installed aft. Instead of the usual tier of bridges, there is but one central tower and a tripod mast with platforms for searchlights, and direction and control stations.

SINGLE DROP OF WATER HOLDS HUNDRED FORMS OF LIFE

Although a drop of water no larger than a buckshot may appear crystal-clear to the unaided eye, it will resemble a small aquarium if it is greatly magnified. Study of a drop from one of the ponds of the New York zoological gardens showed that it was teeming with as many as 100 forms of life. It was spread upon a glass slide and examined with a high-power microscope. One of the organisms observed was a curious animal with an oddly formed triangular body with two spinning "pinwheels" as means of locomotion. It appeared to have the sense of sight for it avoided colliding with other objects and would reach out with its body to grasp convenient surfaces to help its progress.

FOLDING GASOLINE CAMP STOVE HAS TWO-GRATE OVEN

Folding stove and oven are combined in a compact outfit for the auto tourist or camper. It uses gasoline for fuel, has two burners and also two grates in the oven compartment. Legs on each corner swing back against the body when the stove is folded. The oven acts as a protection when not in use, to shield the flames.

Folding Stove Complete; Fuel Tank in Front

SMOKE SOUNDS FIRE ALARM BY SHADOW ON TUBE

Photo-electric cells, the extremely sensitive units that play an important part in the transmission of pictures by wireless or

Sensitive Cell That Sounds Fire Alarm

telegraph, have been further adapted to the practical service of silent sentinels, which guard against fires wherever an automatic alarm is needed. They are so delicate that the shadow of a wisp of smoke, passing between them and a beam of light directed upon the cells, causes an action that completes an electric circuit and sounds an audible fire call. Another marvelous invention recently exhibited is a ground microphone intended to locate men entombed in mine disasters. It already has been used with great success in finding leaks in gas mains, and is so delicate that the dropping of a pin in its immediate vicinity can be detected, as can almost any sound underground.

PRODUCTION OF ARMY SHELLS INCREASED BY NEW METHOD

A casual suggestion offered by a reserve officer at a meeting of army ordnance experts, promises to simplify the task of producing steel tubing for shells up to ten inches in diameter. In case of emergency, it is believed they could be manufactured at the rate of thousands a day without additional machinery, whereas during the war, single factories were limited to outputs of 200 or 300 a day, as the pieces had to be first turned to size, pointed on one end and squared off at the other in lathes, and then bored out. By the new process, the shells will be spun from the whirling red-hot seamless tubes which are now produced commercially for gas-well use in virtually all sizes required for artillery purposes up to ten inches in diameter. "They just cut 'em off like sausages," was the way one officer described the method, which already has been tested. Boring out the squared and pointed ends after the spinning to make place for the explosive charge and fuse automatically removes the impurities in the metal, because the spinning process forces them to accumulate in the center.

REGISTER TO MEASURE NOISE SHOWS QUIETEST PLACES

What spot in the city is the noisiest? How much more racket does a motor truck make than some other vehicle? Guesswork in answering these and similar questions is said to be eliminated by a noise detector which an eastern inventor has devised. By using it on the tops of buildings, and other places, and comparing scores, he has found that in New York city, the noisiest locality is in the vicinity of Sixth avenue and Thirty-fourth street, while the quietest is in Grove street, Greenwich village. Human beings contribute very little to the clamor of the city, while motor trucks are the worst offenders, the detector indicates.

Noise Detector in Use on Top of City Building; Sounds from the Street Are Registered

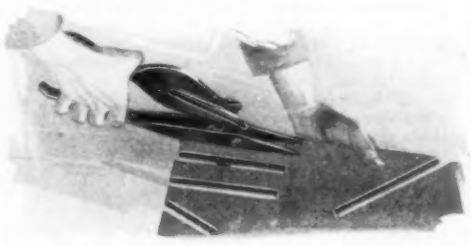
SIXTY-FOOT MODEL OF OLD CITY BUILT BY GIRLS

Interesting features of the old city of St. Augustine, Fla., as well as of a large addition which is being constructed by pumping up sand from the sea, are revealed in an accurately built model made almost entirely by girls under the direction of an Australian artist. Ten tons of real water were needed for representing the ocean and Matanzas river, channels and depressions being constructed for holding it in such a way that it would not damage the miniature streets and buildings. Yachts, speed boats, the shrimp fleet of St. Augustine and other craft are also represented in models which are made to move in a realistic manner.

St. Augustine, Fla., the New and Old Sections at a Glance; Girls and Their Director Completing the Sixty-Foot Model

SLATE AND ASBESTOS CUTTER ALSO PUNCHES HOLES

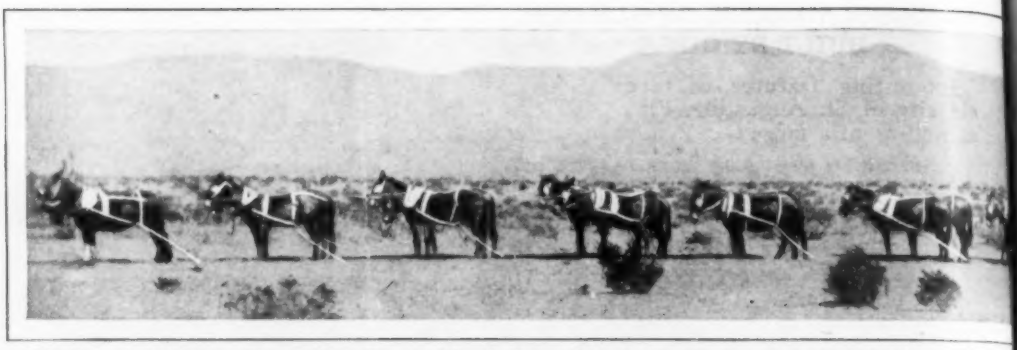
For greater speed and convenience in laying slate or asbestos shingles, a combination tool now on the market is said to cut or punch holes in either material without waste and with clean edges. It is manipulated somewhat like a pair of shears, powerful leverage on the blades being applied with handle grips. The cutter is especially useful in fitting shingles around irregular parts of a roof and reduces the number of tools required, besides saving considerable time.



Slicing Channels in Slate Shingle with Special Shears; Tool Also Punches Holes, Leaving Clean Edges

LOCOMOTIVE IS JUST A "HOG" TO RAILWAY WORKERS

Like many other trades, railroading has developed a slang all its own, rich in words and phrases that show invention and are expressive of the life the railroad man leads. Among the more familiar terms and their meanings are the following: "King snipe," the equivalent of a section foreman; "hog," a locomotive; "hop toad," a derail; "reefers," refrigerator cars; "big hole," emergency air application; "master maniac," master mechanic; "hand-out," a free meal; "bull fighter," empty coach; "old man," superintendent; "pink," a rush telegram; "ham," amateur telegrapher; "sacred ox," Mallet-compound locomotive; "shiner," trainman's lantern; "blow-in," arrival; "bear," the sixteen-hour law.



The Last of the Famous Twenty-Mule Teams of Death Valley Approaching the End of the Final Trip, Last November, When Motor Trucks Replaced Them on the Desert Mine Roads

Driving the Last Twenty-Mule Team across Death Valley

By JACOB ALLRED

Last of the drivers of the twenty-mule teams

THE iron mule has driven the flesh-and-blood animal from the desert, and all us "twenty-mule skinners" are either dead or out of jobs. While we drove we had plenty of adventure, and more work, but science and machinery have beat us and our mules, and I have just seen the last of the teams sold and the wagons broken up for firewood. With the passing of the twenty-mule teams, however, went one of the most interesting phases of transportation in America, a method of hauling freight which made possible the opening of the hottest and most dangerous part of the desert.

The wagons were twenty in number, two to each team of a score of mules. They were the largest wagons ever built. Their beds were sixteen feet long, four feet wide and six feet deep, with capacities of 22,500 to 23,000 pounds of ore. Each wagon, empty, weighed nearly four tons. Since there were two wagons to a team, the twenty mules hauled, each trip, a load of about thirty-one tons, exclusive of the water tank which trailed behind, the feed for the animals and men, and the driver and his "swamper," or assistant.

The rear wheels on these wagons were seven feet in diameter, and the front wheels five feet. Their tires were eight inches wide and one inch thick. The hubs were twenty-two inches long and eighteen inches in diameter, with spokes of split oak, five and one-half inches wide at the hub and four inches at the rim. The felloes were made double, bolted together with three-quarter-inch steel bolts. The axles were solid steel bars, those for the front wheels being three and one-quarter inches thick and those for the rear wheels three and one-half inches. One quart of axle grease was required for each hub at each greasing.

The tongue reached only to the collars of the "wheelers," or rear pair of mules, which did all the turning of the wagons, the other eighteen mules being useful only for hauling. This tongue was a solid piece of straight-grained oak, which, as I remember, cost $50 in the rough. It was eight inches square at the wagon, and five inches square at the front end. Fastened to the end of the tongue was a chain, with links of half-inch steel, hand-made, running through the entire team, bolted to the whiffletrees at the rear of each pair of mules and connected by steel chains to their col-

THE CHANGING WORLD

FOR some thirty years all the supplies for and ore from the mines located in the mountains surrounding Death Valley, Calif., have been hauled in and out in huge wagons, drawn by teams of ten pairs of mules. Driving these teams, fighting off renegade Indians and bad white men, became a profession requiring a cool head, quickness and accuracy with a gun, knowledge of mules, and resourcefulness. Now the tireless motor truck, laying its own steel road, making two trips to the mule team's one, and hauling more freight at each trip, has driven the last of the twenty-mule teams from the California desert.

Jacob Allred, Last of the Twenty-Mule Drivers and Author of the Accompanying Article, Is Shown on the Seat; the "Swamper" Standing beside the Wheel Gives an Idea of the Size

lars. There were no yokes, since the twenty mules were trained to pull together like one team. Each mule was connected to the singletree with wide leather braces.

The team was driven, not by reins, but by a single quarter-inch, smoothly woven round rope, running from the driver's seat to the bit in the mouth of the right-hand mule of the lead team, and thence passing to the bit of the left-hand mule of the same pair, where it ended. The team was turned to the right by pulling on this rope, and to the left by slapping the neck of the right-hand lead with it. To execute this slap required considerable skill on the part of the driver, as did also the handling of the whip which had a handle six feet long, a twenty-two-foot lash, and was used merely as a "cracker" above the backs of the mules. The driver had to use both hands and his body when he wielded it, and he also carried a box, filled with small pebbles, on the seat beside him. These stones he threw at individual mules when they did not do their share of the work. It was part of the swamper's duty to see that this box was kept filled, and some of the drivers became real experts in "laying down" a stone on the back of a mule which needed encouragement.

Since none of the twenty mules, except the wheelers, could help in holding back the wagon on the downgrades, the brakes on the wagons were huge affairs, with handles made of steel bars, two inches wide, three-quarters of an inch thick and ten to twelve feet long. To use such a brake on the front wagon, the driver stood up on the seat, letting the team follow the leaders, and threw his whole weight on the upper end of the bar, while the swamper braked the rear wagon. If the brake broke, the whole went into a pile at the bottom of the hill.

With such an outfit, a water tank trailing behind, and an extra, or relief, pair of mules led back of that, we drivers hauled 45,000 to 46,000 pounds of ores from 300 feet below sea level, in Death Valley, and from the mountain ranges on either side of the valley, some 140 miles into Johannesburg, and 120 miles or more into Daggett. We dodged Piute Indians, renegade Apaches from the reservations in Nevada, New Mexico and Arizona, fighting them when we had to; standing off worse white men; calculating our day's run so as to reach a water hole, which, more often than not, was dry when we arrived; protecting our teams and ourselves from heat and from the deadly sidewinders, the small rattlesnakes of the desert, and, with all this, maintaining regular schedules with mail and food supplies for the mines and the lonely ranches on both sides of Death Valley.

One of the Trucks Which Gather the Ore Trailers and Haul Them to Stations Where the Tractor Trains Are Made Up

Much depended on the leading team of mules. If they understood their duties and did

them, the remaining eighteen animals followed through. If they did not, the driver had a job cut out for him, because he had little or no control over the long team except that which he could maintain by means of the "tunkline" working on the leaders. In the old days, such a team was worth all the way up to $1,000, but when my team was disbanded, I bought "Jane" and "Judy," who had been my leaders for more than six years, for $100, and the boss was glad to get that for them. What has become of the other drivers, I do not know, probably many of them are working in distant parts of the desert, and some are dead.

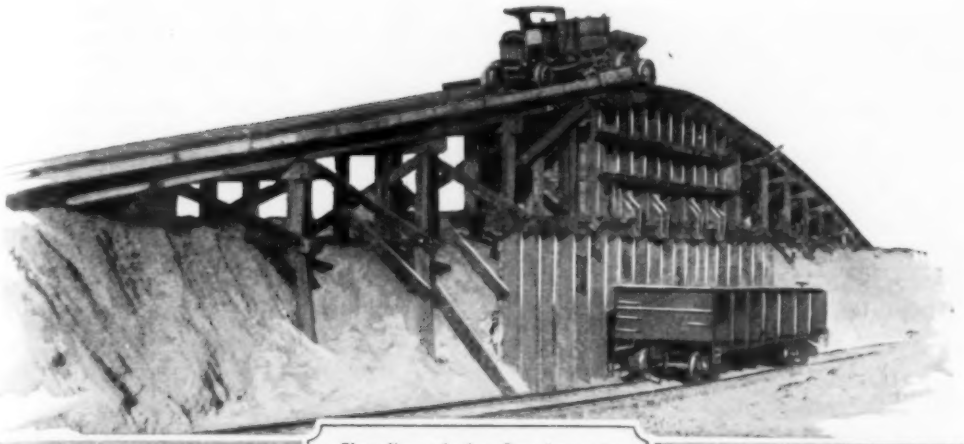
Truck Train, Outward-Bound to the Mines with a Load of Lumber and Supplies; These Outfits Have Conquered the Worst Perils of the Desert and Speeded Up Transportation

For twenty years, I drove a twenty-mule team. Before that, I was a swamper for Fred Hinkle, the king of the twenty-mule-team drivers, and the quickest man with either rifle or revolver who ever picked up a tunkline and shouted "Yo-r-r-rup" to a score of mules all tied together. When I started driving there were forty of us. We were paid $100 a month and our food, bedding, guns and ammunition, while our swampers got $80 a month. If we had trouble on the road, either with men or with weather, and pulled through to our destination with only small loss of time, we received a $5 bonus, and there were very few trips in those days in which the teamster did not meet with bad Indians, desert sandstorms or dry water holes. Don't laugh when I say that cloudbursts were among our worst troubles. These sudden downpourings from the skies, covering often only a few acres, are frequent and deadly on the plains of the desert and in the mountains around Death Valley. They completely destroy anything they hit; they fill canyon trails with bowlders which cannot be moved; they slide whole mountains into valleys overnight; they fill up springs and water holes, and they so completely change the topography of the country in a few hours that even an old "desert rat" will become lost.

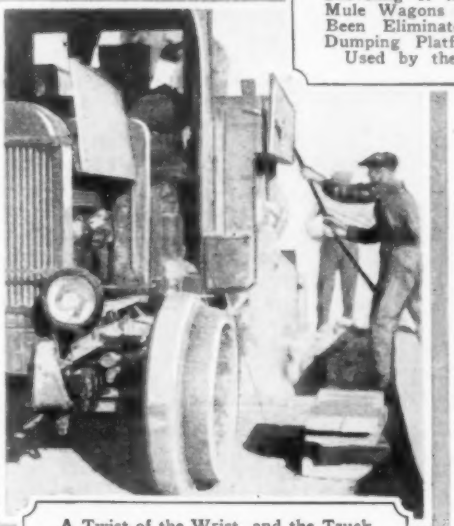
Fred Hinkle, whom I mentioned before, drove an express buckboard pulled by four fast mules, prior to becoming a teamster for the twenty-mule-team outfit. In the early nineties, while Hinkle was so engaged, there was an epidemic of robberies by white men all along the trails into and out of Death Valley. Hinkle, who was then nearly fifty years old, but hale and strong, put two old revolvers, loaded with blank cartridges, in holsters and fastened one to the dashboard, with the other on the seat, just beneath his right hand. Then he strapped on two short-barreled double-action guns, one under each arm, and put on a blue-denim jacket, concealing both weapons.

At Indian Point, two white men held up Hinkle and his express buckboard. Making him get out of the vehicle, they took the guns from dashboard and seat, and started search for a package containing $5,000 in gold, the pay roll of a mine on the eastern side of Death Valley.

Regarding Hinkle as badly frightened, one of the robbers lifted the seat cushion while the other searched for the valuable package. The instant they turned from him, Hinkle whipped out his other guns and fired, killing both bandits, firing left and right at the same time and



Shoveling of the Ore from the Mule Wagons to the Cars Has Been Eliminated by a Special Dumping Platform and Hopper Used by the Truck Trains



A Twist of the Wrist, and the Truck Load Is Dropped into the Waiting Car, Eliminating Waste of Time in Unloading

Entrance to a Mine in the Furnace Creek Mountains, on the Eastern Side of Death Valley, Which for Twenty Years Shipped Its Ore and Received Supplies by Mule Team

Barrel Cactus, Which Has Saved Many Lives, and Map of the Mule-Team Routes in Death Valley (Dotted Lines)

using only one bullet from each gun. Bill Ferguson was another of the greatest of the twenty-mule-team drivers. Bill arrived at Maybe Point one night, on his way from Daggett to Bennett Wells, on hitched up the twenty mules, and drove the 100 or more miles to Bennett Wells, feeding and caring for the insane man all the time.

Arrived there, the mine authorities

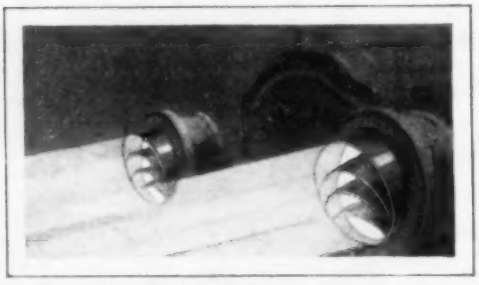
Mining Camp on the Rim of Death Valley, and a Few Feet above the Level of the Pacific Ocean, 200 Miles Away; the Valley Itself Is 300 Feet below the Level of the Sea

the northwest corner of Death Valley. With him was his swamper, Charlie Meiser. During the night, Charlie went violently insane, fleeing into the hills under the hallucination that the Indians were after him. Ferguson followed the unfortunate man, caught him, knocked him unconscious, carried him back to camp, tied him to the wagon and went back to sleep. In the morning he made the swamper as comfortable as possible in one of the wagons, watered, fed and would not take charge of Meiser, so Ferguson carried him back to Daggett, driving, feeding, watering, hitching up the mules, standing guard at night, sleeping a little by day on the wagon, braking the heavy loads down the grades, and meanwhile taking the best care of Meiser.

If driving the twenty-mule teams was a hard life, survived only by hard men, nevertheless it built up character, resourcefulness, courage and friendships which endured until death.

DEFLECTORS FOR AUTO LIGHTS ELIMINATE DIMMING

The bother of turning a switch to dim the auto headlights is eliminated by using a set of curved shields which direct the



Deflectors in Place Showing How They Bend the Headlight Rays Downward to Prevent Glare

rays of the lamps downward to the roadway where they do not shine in the eyes of approaching drivers, yet sufficiently illuminate the path ahead. It is not necessary to dim the lights at all. The shields consist of four elliptical visors, easily attached by removing the lens and rim from the headlight and fitting them inside the rim where they are held fast by a flange. They rest in front of the lens so that they do not conflict with state laws.

ELEPHANT CEMETERY MYSTERY CLEARED BY SCIENTISTS

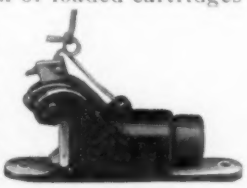
One of the most persistent "travelers' tales" from Africa concerns the mysterious elephant "cemeteries," secluded spots, where the huge beasts were thought to retire, when old age or sickness overtook them, and wait for death. The basis for the stories is found in native legends and received apparent verification in collections of elephant bones discovered in various parts of the country inhabited by the herds. But after considerable investigation, scientists and big-game hunters have

decided that the cemeteries are not the result of a peculiar habit of the elephants but are due primarily to the question of water supply. Herds make repeated visits to secluded spots where there is an abundant amount of good water for drinking and bathing, and they also use these retreats for hiding. In course of time, the bones of elephants that died near these places have accumulated. In one of the cemeteries, it was evident that all the bones had suffered about the same amount of weathering, indicating that the beasts had died at about the same time. Careful inquiry among the old men of the native tribes shattered the apparent mystery surrounding this find. Years ago, the elephant country was visited by a severe drouth. Springs of pure water dried up and only those that contained a poisonous chemical remained. Men as well as animals died from drinking it. Because of their great size, the bones of the elephants are about the only remaining evidence of the great death, and it is believed that legends of the supposed elephant cemeteries were inspired by the remains found there.

Mr. Benda Putting the Finishing Touches on His Huge Mask of the "Green Monster"; Smaller Masks at the Left of Figure

ALARM SCARES BURGLARS AWAY BY FIRING OFF GUN

For protection against burglars, an alarm that fires blank or loaded cartridges is now on the market. It consists of a short-barreled gun fastened to entrances by screws through the base, and has a sliding breech block and a spring-operated hammer released by a string, when the door is opened. Sixteen-gauge shells, or a charge of gunpowder and photographer's flash powder simply to scare the intruder, may be used.



ART MASK OF "GREEN MONSTER" DESIGNED FOR BALL

Garbed in figured silks and decorated with brilliant colors, a huge mask of a "green monster" was designed by W. T. Benda for a New York ball. The creation is a development of the famous character masks which this artist devised for stage use. They are intended to portray dominant traits of the persons represented, and fit the face closely.

GRASS-FIBER BUILDING BRICK

Bricks prepared from shredded fibers of palmetto, sea grass or other similar material have appeared on the building markets and are said to have proved satisfactory in various types of construction. They are considerably larger than the ordinary brick and can be arranged to form their own mold for reinforcing pillars of concrete, or on like jobs.

Removing the Phonograph Cover to Change Records; Doll's Clothing Conceals Top

PHONOGRAPH HIDDEN IN DOLL PLAYS CHILD RECORDS

Concealed inside the body of a "talking" doll introduced in Paris, a small phonograph plays records which reproduce the voice of a small child. Both song and speech are faithfully imitated. Mechanical noises are said to be almost inaudible because of the construction, and the records can be changed easily.

DRAIN ON ELECTRIC CURRENT HEAVIEST TUESDAYS

The peak load in the consumption of electricity for domestic purposes comes, not on Saturday nights, as many persons believe, but on Tuesday morning about 9 o'clock, when housewives are using their electric irons after Monday's washing, a city survey shows. Fewer hours of daylight in the winter months naturally require more artificial illumination and a consequent increase in the electric-light bill, but few consumers know exactly how much longer they need lights in winter than they do in summer. Statisticians have figured that, in June, an average of only about 2.55 hours out of the twenty-four, see artificial lighting in the ordinary home, whereas there are about 6.85 hours of electricity burning each day in December.

SECRECY FOR RADIO MESSAGES BY USE OF DICTAPHONES

Far greater use of the radio is seen as the result of the invention of a British scientist who is reported to have found a way to keep wireless messages secret. Instead of using the beam-transmission system, his apparatus is purely mechanical. It consists of a dictaphone into which the message is spoken and recorded upon a register that turns at irregular speeds through the use of elliptical gears. The finished record is then made to "speak" backward into the radio transmitter. At the receiving station, another dictaphone with a record turning at the same speed at which the first revolved, registers the message. By reproducing the result in a certain manner, the original is made intelligible.

HINGED BOWLING PINS KEEP SCORE WITH LIGHTS

Lovers of bowling can enjoy a modified form of the game on a miniature alley, only fifteen feet long. It is played with a cue or stick instead of the usual way. The pins are hinged, and when they are struck, the lower part flies up out of the way, completing an electric circuit which lights a tiny lamp on a board at the rear of the alley. There is a light for each pin. A glance at the board tells how many have been knocked down. They are quickly reset by an automatic racking device. Removable leather tips are provided for the pins to protect them and insure even wear. The game is scored in the same way as regular bowling. The small size of the alley adapts it to rooms of limited area.

Bowling Game Is Played with a Cue, and When Pins Are Struck, They Register Score in Lights on Rear Board

Clouds of Flame Leaping from Pipe at Naphtha Well; Excess Gas Is Burned in This Way After Rest of Product Has Been Consumed in City Near By

FLAME FROM ICE-COATED PIPE BURNS EXCESS GAS

Leaping the year around from a frosty pipe at a naphtha well near Calgary, Can., a 100-foot flame consumes surplus natural gas produced during the refining processes. It has burned about two years, and it is estimated that gas valued at approximately $7,000,000 has been destroyed in this manner.

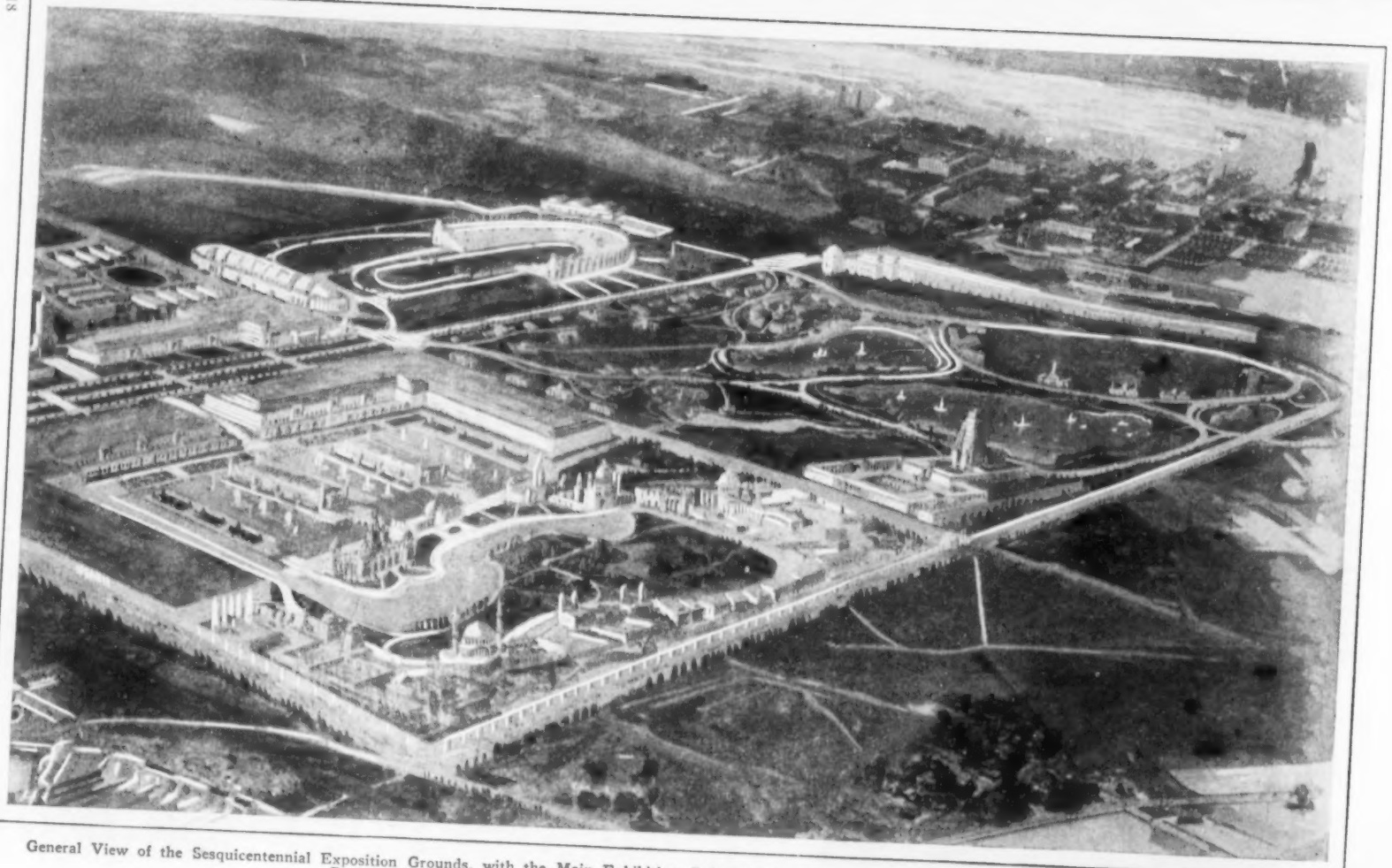
RADIO FOR CATCHING THIEVES DETECTS LOOT

Radio has been used for some time by the police in spreading information to assist in the capture of criminals, and now an inventor has devised a new way to trap thieves by wireless. He utilizes the loot itself to accomplish his purpose. The system is for installation at the entrance to factories, mines or other places where ores, tools or metal objects are likely to be stolen. The gateway is electrically wired in a special manner, and the watchman, wearing a radio headset, listens as men pass out. If they carry an unusual quantity of metal, a noise is heard in the phones and the person can be halted for questioning or search. The apparatus is arranged so that a reasonable amount of metal, such as coins, knives and watches carried by the men, will not produce a signal and cause unnecessary delays at quitting time.

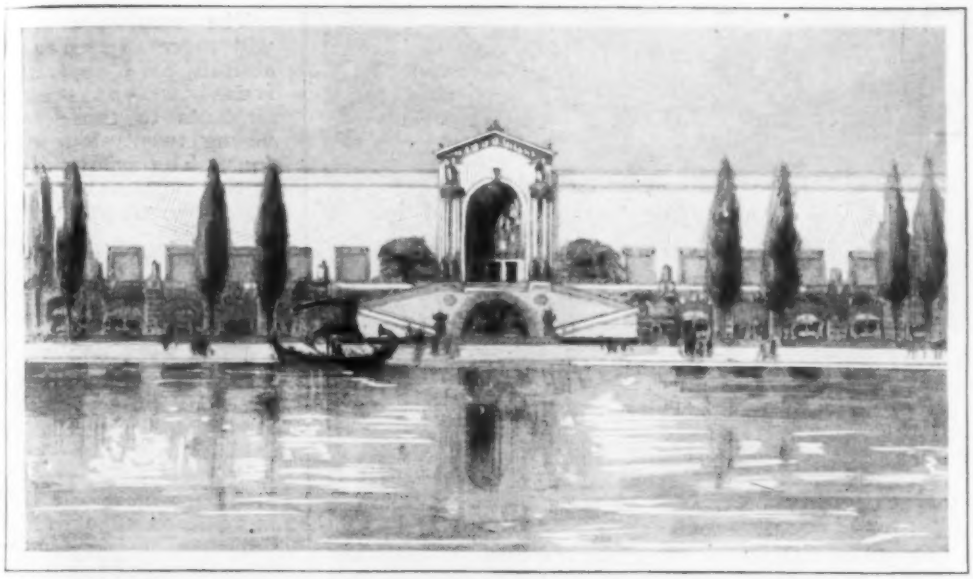
WOMAN AS FISH TAXIDERMIST WINS WIDE FAME

Although her friends advised her not to attempt the work, a California woman has become a successful fish taxidermist and receives orders from sportsmen in nearly every part of the world. She has become an expert at mounting specimens, and not long ago prepared a huge swordfish, weighing over 570 pounds, for exhibit. This species is considered difficult for the taxidermist, on account of the great quantities of oil it contains.

Finishing Work on a Flying Fish; Woman Taxidermist in Her Studio Surrounded by Specimens Prepared for Sportsmen



General View of the Sesquicentennial Exposition Grounds, with the Main Exhibiti on Palaces in the Foreground, the Lagoons and Fountains in the Upper-Right Corner, Back of the Replica of Solomon's Temple, and the Huge Stadium to the Left of Them



Fair to Celebrate Triumph of Invention

American Progress in a Century and Half to Be Outstanding Exhibit at Philadelphia's Sesquicentennial Celebration

MECHANICAL geniuses, both amateur and professional, are going to find their Mecca in the Sesquicentennial International exposition which opens in Philadelphia, June 1, in celebration of the 150th anniversary of the adoption of the Declaration of Independence. The Palace of Machinery, Mines, Metallurgy and Transportation will be the particular magnet that attracts them.

The palace is the largest exhibition building in the exposition, with floor space covering ten and one-half acres. It cost approximately $1,250,000.

Here will be found countless exhibits presenting the last word in mechanical and electrical invention, in many instances accompanied by the earliest example of a similar contrivance, showing at a glance the strides made in the improvement of the article since its original invention. Other exhibits will trace the progress of a mechanism through the various stages of development to present-day completeness.

The power for driving the machinery exhibited will be developed in full view of the visitors. One turbine manufacturer will have a steam turbine directly connected with the generating set producing the electric current for power use. Three uniflow steam engines will be in operation.

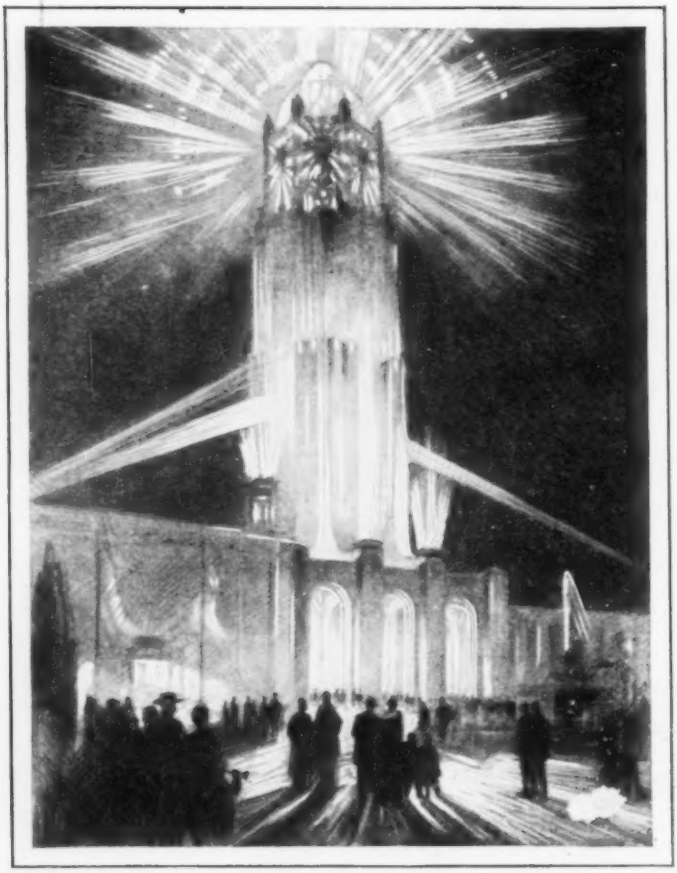
Diesel-engine direct-connected generator sets, ranging from 250 to 8,000 horsepower form an exhibit never before equaled.

Ice and refrigerating-machinery exhibits include an entirely new invention recently developed by one of the largest companies in that line of manufacture.

Exhibits of machine tools and of machinery and equipment for railroad shops, and iron and steel works will cover every mechanical detail of these industries.

Transportation equipment of the most recent invention will be displayed. Side by side with the latest type of electric and steam locomotives will be shown the first locomotive used in the country.

A railroad turntable of the articulated type, 118 feet in diameter, on which steam and electric locomotives alternately will be mounted, is a prominent feature. Elevated six and a half feet above the concrete floor of the building, its design and the electric drive mechanism may be easily examined by visitors. The engines will be run at a speed approximating thirty-five miles an hour. The steam engines employed weigh 310,000 pounds and the electrics from 332,000 to 360,000



The Tower of Light, One of the Many Illuminated Features in Which Lavish Electric Displays Will Be Used

pounds. In transferring the locomotives to and from the turntable, two methods will be demonstrated, that of employing overhead traveling cranes and that of using wrecking cranes.

An entire Pullman train of five cars of up-to-date construction and equipment will show, by contrast with some of the earliest Pullmans, the progress made in this line. The oldest and latest types of freight and passenger cars and street-railway cars will also be exhibited.

The automobile industry will have a strong representation. Leading manufacturers will exhibit the various types of cars, trucks and busses; chassis, tops and bodies, as well as accessories, tools and supplies.

Marine transportation will be represented by steamship models, yachts, motorboats, marine engines, deck machinery, maps, charts, navigation instruments and all recent inventions applicable to water transportation.

The aviation exhibits will cover all types of aircraft and apparatus, from two-passenger airplanes to those conveying twenty-four persons. The aviation field at the exposition, covering 120 acres, will be the scene of many flying events arranged by the military and naval authorities and aeronautic organizations.

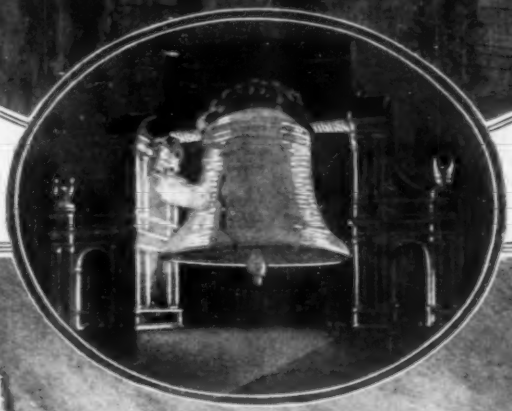
Radio fans will come into their own at the exposition. Inspection and study of the numerous exhibits will come very near to satisfying the demand for more and still more knowledge of the subject that is fascinating millions of minds the world over. It is the first world fair at which such an exhibition is possible. The wonders of the radio will mark the topnotch of advancement in civilization.

Steel manufacturers will show every phase of the industry from the mining, refining and chemical treatment of the various ores to the finished product. An interesting part of this exhibit will be the first-aid and sanitary-welfare system employed by the majority of the larger companies.

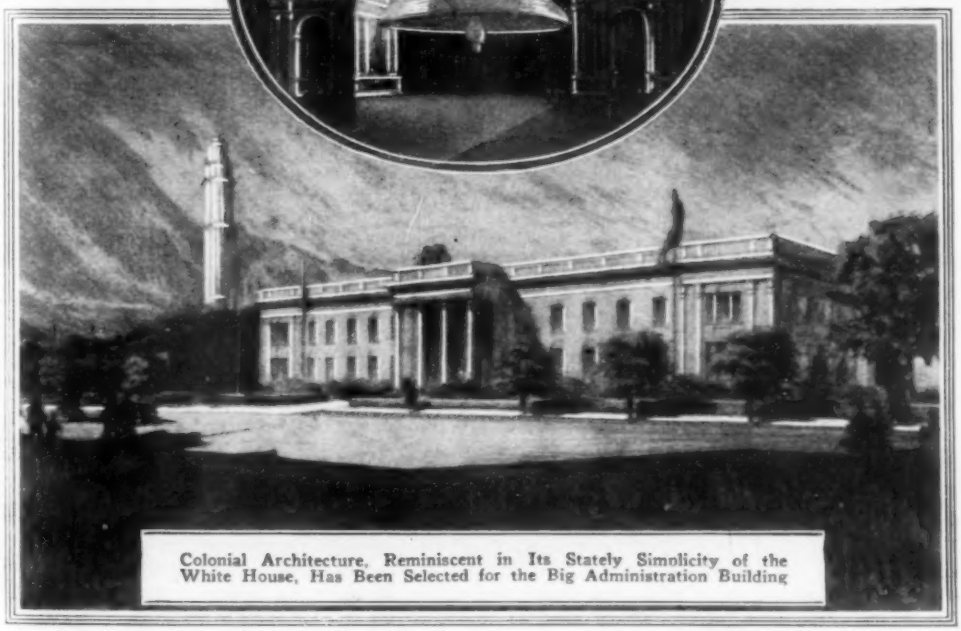
A house, built almost entirely of rustless steel and equipped throughout with furniture of the same metal, presents the last word in fireproof construction. The carpets, upholstery and draperies with which it is furnished, being treated with a chemical preparation, are likewise non-inflammable. The structure composed of standardized parts, bolted together, and a garage of similar construction will be found located near the Palace of Machinery, Mines, Metallurgy and Transportation. About thirty leading steel-manufacturing companies in the United States are members of the association which constructed it. Each firm has its own exhibit in the palace.

Oil companies will show the drilling of wells and refining processes, and will demonstrate many things of interest to the ever-increasing number of oil users.

The Vestibule of the Palace of Agriculture, Food and Dairy Products Shows One of the Lovely Vistas of the Exposition



An Enormous Liberty Bell, Studded with 20,000 Electric Lights, Will Span the Main Approach through Philadelphia



Colonial Architecture, Reminiscent in Its Stately Simplicity of the White House, Has Been Selected for the Big Administration Building

Fire-fighting equipment will form an interesting display and serve to make more clear to the man in the street the methods of battling with flames than he is able to grasp in the hurry and bustle attending a real fire.

The advantageous burning of powdered coal will be demonstrated by the exhibits of a number of manufacturers of boilers and mechanical stokers.

Electrical-machinery manufacturers will show motors, generators, switchboards, switchboard apparatus and endless other lines of electrical equipment and supplies. A large section of the palace is devoted to this industry.

The progress of the Bell telephone, first put to public use at the Centennial exposition of 1876, and at that time regarded by many as merely an interesting toy, to the development of the dial system and other late improvements will interest thousands of visitors. Great interest will be created by the exhibit of recent inventions for sending pictures by wire.

The foregoing are but a few of the exhibits that will interest and enthrall the man of mechanical bent. No greater testimony to the degree of civilization reached by a nation but a century and a half old could be offered than is presented by the collection of modern wonders housed in the Palace of Machinery, Mines, Metallurgy and Transportation.

The two buildings ranking next in size are the palaces of Liberal Arts and of Manufactures, each with floor space of eight and a half acres.

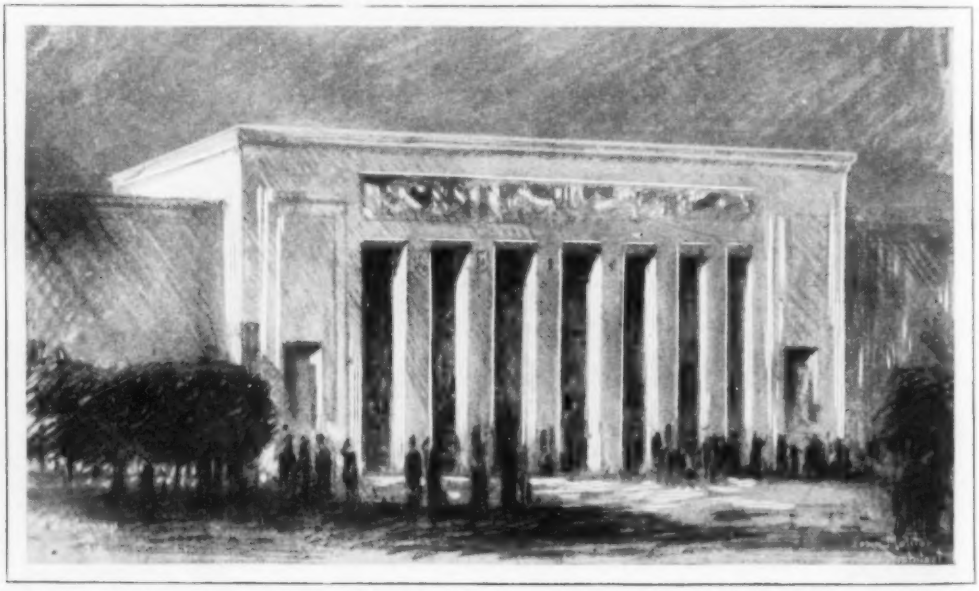
The stadium, accommodating 100,000 and providing additional exhibition space beneath the tiers of seats, covers five acres. Here will be held historical pageants, gala musical festivals and athletic games on Olympian scale with champions from all parts of the world in competition.

The auditorium which seats 20,000, provides three acres of floor space for the many conventions that will be held there during the summer. Concerts and other entertainments as well as lectures on many subjects will be given from time to time.

The administration building provides a quarter of an acre of space for the executive conduct of the exposition. A score of additional buildings represent the participation of as many foreign, government, state and commercial interests.

The Gladway provides a circular promenade of a mile and a quarter, along the outside of which are situated the amusement features and other concessions contributing to the lighter side of the exposition. Inside the Gladway a beautiful park inclosure will be found, with twelve acres of lagoons adding charm and variety to the landscape.

Motion pictures made on the spot will be a compelling attraction at the "Sesqui." The mysteries of the studio will be unveiled at the local Hollywood erected on the grounds, where leading cinema



The Portico of the Huge Palace of Liberal Arts, One of the Largest of the Exposition Buildings, Shows the Attractive Simplicity Obtained by the Use of Tinted Stucco for the Walls

stars will take turns in making actual pictures.

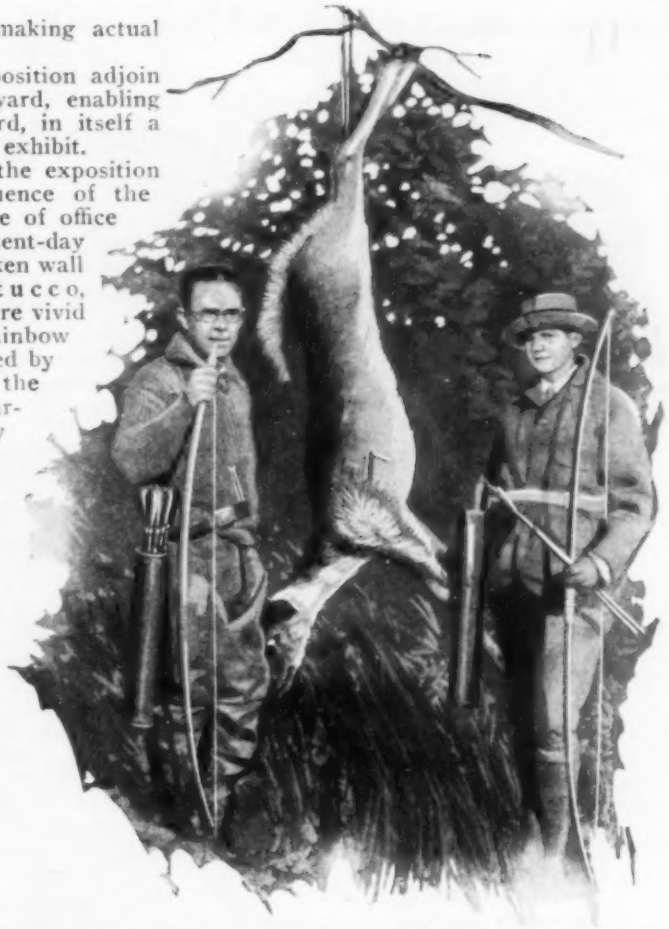
The grounds of the exposition adjoin the League island navy yard, enabling visitors to inspect the yard, in itself a noteworthy governmental exhibit.

Architectural design of the exposition buildings shows the influence of the most modern set-back type of office building developed by present-day zoning laws. Large unbroken wall spaces of pastel-tinted stucco, with decorations in the more vivid primary colors, supply a rainbow effect which is supplemented by colorful floral schemes in the surrounding landscape gardening by day and by unique lighting features by night.

The lighting arrangements are unprecedented in the history of artificial illumination and will not be confined to the exposition grounds. The city of Philadelphia extends north and south approximately twelve miles, and west from the Delaware river about six miles. Throughout this area, and far beyond in all directions, will be reflected the luminosity of some of the most spectacular lighting effects ever attempted.

Concentration of 6,300,000,000 candlepower at a point beyond the new Art Museum, situated at the main entrance to Fairmount park, some five miles from the exposition, will not alone flood the city with light but will constitute the Philadelphia aurora visible in New York, Baltimore, far inland, and for miles out at sea. This will be accomplished by massing fourteen super-power searchlights fitted with projectors and color screens to throw fanlike and crisscross rays in all the hues of the rainbow. A spectacular effect will be produced resembling nature's aurora borealis or northern lights.

The tower of the City Hall, which is surmounted by a colossal statue of William Penn, thirty-seven feet high, and situated about a mile from the Art Museum, will be thrown into strong relief by powerful searchlights placed back of the buildings and casting a glow of pink light. The parkway connecting these two points will be an avenue of light.



Deer with One of the Arrows Still in Its Side; Shot Was Made by Woman Archer at Twenty Yards

WOMAN ARCHER KILLS DEER AT TWENTY YARDS

That archery is not only a pleasant diversion but holds possibilities for the modern hunter is seen in its revival in the quest of big game. What good aim, a trusty bow and arrows will do, even in the hands of a woman, was illustrated recently when a young huntress in Louisiana brought down a deer at twenty yards. Three shafts were used, all striking near the animal's heart.

¶If cave men were healthier than people today, one reason was that they didn't eat so much, according to an English scientist, who asserts that one cause of cancer and appendicitis is overloading of the stomach and that modern men consume from three to four times as much food a day as their stone-age ancestors.

U. S. SPECIALIST IN CIGARETS AIDS MANUFACTURERS

Collecting samples of cigarets from all countries of the world where they are

© H. Miller

Mr. Hill Collects Sample Cigarets, Not as a Hobby but to Aid Tobacco Merchants

produced, is one of the tasks of Benjamin D. Hill, tobacco specialist of the department of commerce. From his testing and examination of the specimens, he obtains data helpful to American manufacturers interested in exporting their products. More than 10,000,000 cigarets are sent from the United States to foreign countries every year.

MYSTERY OF ICE BLOSSOMS SOLVED BY SCIENTIST

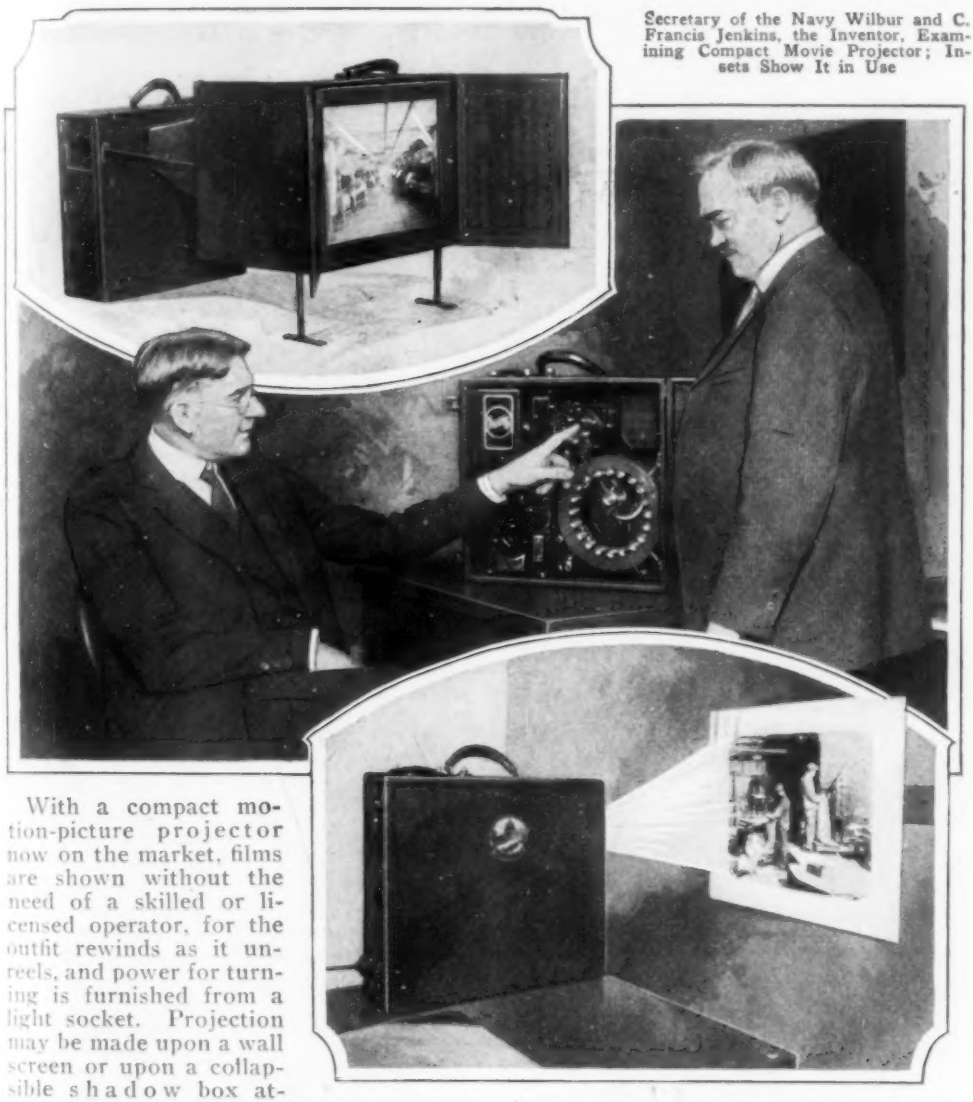
On cold, frosty mornings, from November to January when the ground is not frozen, delicate white "blossoms" of ice are frequently seen on the stems of various kinds of plants. For many years scientists have been puzzled as to the manner in which these crystal flowers were formed. Did they develop, just as frost does on a window pane, as a result of dampness from the surrounding air or from moisture inside the plant itself? From experiments conducted by Dr. W. W. Coblentz, of the bureau of standards, it appears that the latter is the correct explanation, and that the moisture which produces the blossoms originates from the little sap tubes in the stem of the plant and not from the pith, as another scientist had believed. To solve the question, Dr. Coblentz cut a bunch of dried stems of a plant which has many sap tubes in its stalk, peeled the bark from some of them, mounted the collection in a heavy piece of pasteboard and cemented it in tightly. The ends were inserted in a glass test tube partly filled with water, and they were then placed on a window sill on a cold, frosty night. They were carefully covered so that the moisture from the air could not be deposited upon them. One of the stems that had been sealed, to keep the water from being drawn up through the sap tubes, formed no fringes or flowers, but all the rest did. Further tests were made by coating the stems with shellac. No fringes were formed, indicating that the moisture had to come up from within the plant. To make sure that the bark did not carry the necessary water for forming the fringes, the stems were coated with a substance which would keep any moisture from creeping up the bark, and the test tube was filled with colored water. The next morning, the dye was discovered oozing from the stems, showing conclusively, the experimenter declared, that it had been drawn up through the sap tubes. Further proof was seen in the fact that in each case considerable water had disappeared from the test tube. These ice flowers often form on pieces of unglazed pottery lying upon wet soil.

ALTERED NUMBERS ON MOTORS DETECTED BY CHEMICALS

Philadelphia police have tested a way of detecting alterations in the manufacturer's numbers on automobile engines that promises to aid in the identification of stolen cars and capturing the thieves. First, a special chemical is applied to the number, which is then heated with an acetylene lamp and a second coating with a different chemical applied. When a photographic impression is made, the original number is said to appear in spite of any alterations that may have been made by a thief.

Examining Motor Number with Chemicals

MOVIE PROJECTOR IN SUITCASE NEEDS NO OPERATOR



Secretary of the Navy Wilbur and C. Francis Jenkins, the Inventor, Examining Compact Movie Projector; Insets Show It in Use

With a compact motion-picture projector now on the market, films are shown without the need of a skilled or licensed operator, for the outfit rewinds as it unreels, and power for turning is furnished from a light socket. Projection may be made upon a wall screen or upon a collapsible shadow box attached to the case, which is only five inches deep, about eighteen inches long and slightly less in height. It weighs less than twenty pounds complete. A feature is that, with a range of only fifteen feet or so, the pictures are as large as at a distance of seventy feet with an ordinary projector. In case the film breaks while showing, a switch automatically stops the machine. Because of the way the film is wound, there is said to be less wear, and a safety sixteen-millimeter size is used, keeping the cost of the prints to a minimum. The projector is specially suited for schools, business purposes and for lecturing as well as for amusement at home. It holds up to 1,000 feet of film.

LIFE LINE IS FIRED BY RIFLE TO AID SEA RESCUES

Fired from the shoulder like a sporting gun, a special rifle for shooting life lines to persons in shipwrecks, is also used by steeplejacks in fastening cables to high chimneys or other places. A long rod fits into the muzzle of the rifle, and to it is attached a line seventy yards long. It is so arranged that the bullet can be accurately aimed and is very strong.

Young Jake Schaefer, World's 18.2 Balk-Line Billiard Champion and Son of a Famous Champion of the Last Generation, Is Noted for the Coolness of His Nerve and the Perfection of the Bridges He Employs in Such Difficult Shots as This Masse, in Which the Cue Ball, Twice Describing the Arc of a Circle, Strikes Both Object Balls

Magic in Ivory Balls Solved by Diamonds Which Make Amateurs Experts

By J. EARLE MILLER

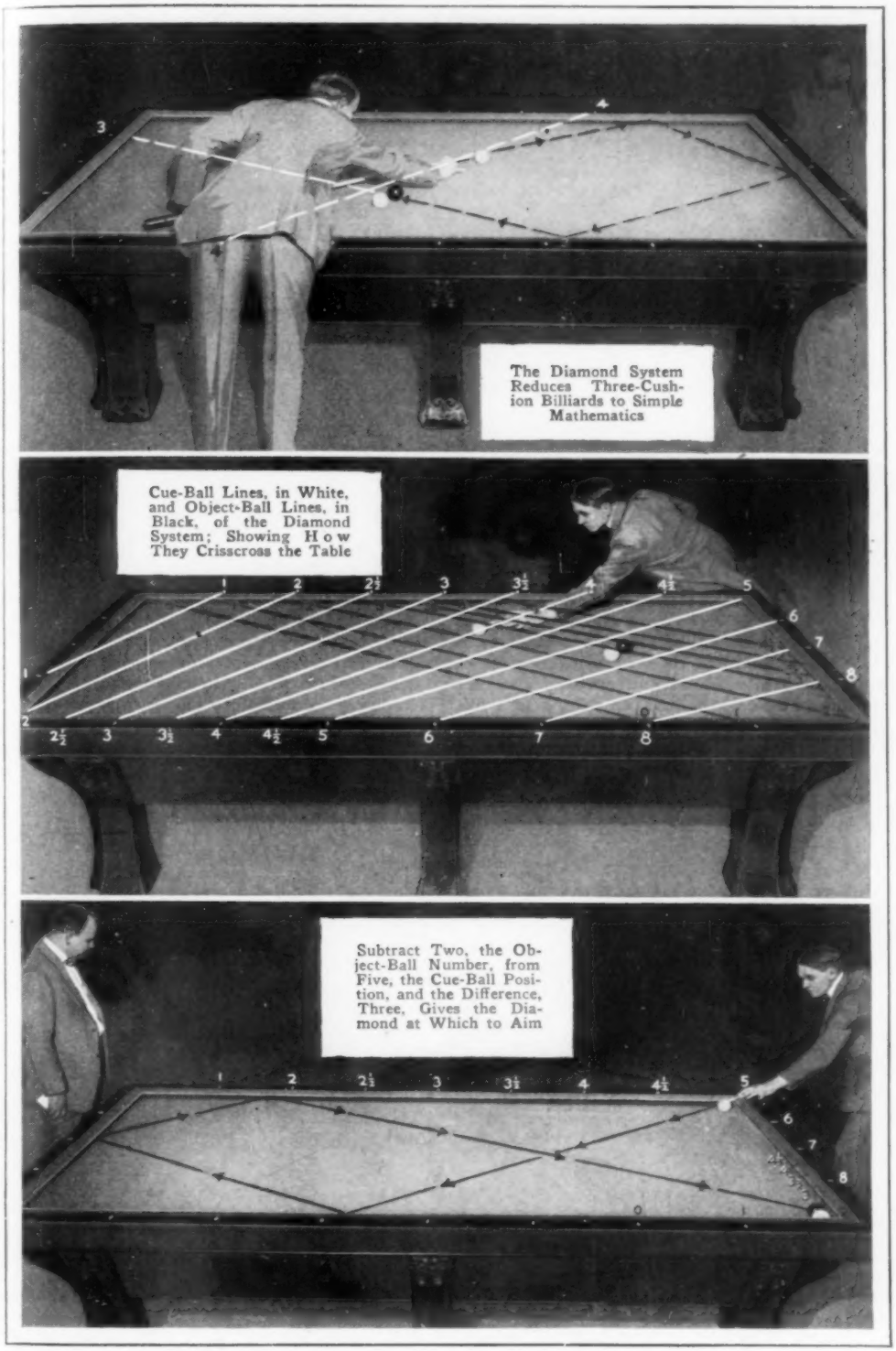
MAKING a trio of ivory balls perform weird gyrations around a green-felt table by the application of simple mathematics bids fair to make three-cushion billiards the leading favorite of all the ivory-ball games. Through the application of an ingenious "diamond system" any inexperienced player can determine off-hand where to shoot to make the necessary three caroms off the cushion before the second object ball is hit.

The mathematical diamond game is so fascinating that, at the University of Chicago, a class of college professors, including Albert H. Michelson, the famous mathematician, has been formed to study it under a professional coach.

Three-cushion billiards thrills the spectator and amateur player for the same reason that a free-hitting baseball game or a "Red" Grange on the gridiron does—there is more action to it. The tournament game of 18.2 balk-line billiards is like a no-hit, no-run baseball game, a fine example of great skill, but not very thrilling for the spectators, or the opposing players.

Young Jake Schaefer, the balk-line champion, and Edouard Horemans, the Belgian, from whom Schaefer recently regained his title after losing it the month before, frequently run from 100 to 200 or more points at a time, displaying remarkable skill, but such long runs rather lack excitement for the balls are grouped together and then nursed along with the minimum amount of movement required by the rules. The three-cushion game, on the other hand, affords plenty of action, but, until the diamond system was perfected, many amateurs found it too difficult.

The mathematical system of computing angles at which shots must be made to get the necessary bank from three cushions, derives its name from the use of the ivory diamonds inlaid in the table edge as guide markers. It is only necessary to memorize two sets of numbers, one for the cue-ball position and the other for the object balls, and then subtract the latter from the former, the


The Diamond System Reduces Three-Cushion Billiards to Simple Mathematics
Cue-Ball Lines, in White, and Object-Ball Lines, in Black, of the Diamond System; Showing How They Crisscross the Table
Subtract Two, the Object-Ball Number, from Five, the Cue-Ball Position, and the Difference, Three, Gives the Diamond at Which to Aim

difference indicating the position on the table at which the cue ball should be aimed to strike three cushions before the object balls.

The player still must estimate the proper amount of "English" to use, and can display his skill at calculating the direction the cue ball will take after striking the first object ball, when the two are separated. The diamond system only solves the first, and purely mental, problem of where to shoot, leaving the rest to the individual skill of the player.

The simplest of all three-cushion shots, with the cue ball in one corner and the two object balls together in another, illustrates the basis of the system. The cue-ball numbers, starting with the first diamond at the other end of the table, run from one to five for the corner diamond, and up to eight for the three end diamonds. The object-ball numbers, starting around the end of the table, run from zero to four and a half, the two coming in the corner. Thus, the cue-ball number in the corner being five and the object-ball number two, the difference is three, and the player, counting diamonds from the opposite end of the other side of the table, aims at the third diamond. The ball caroms off the side cushion, strikes the end, banks straight for the second diamond on the other side, and from there to the opposite corner, striking the two object balls.

When the balls get out into the middle of the table, the game becomes more complicated, unless the imaginary numbered lines are well memorized, since the lines are not parallel, half numbers resulting in converging lines. The opposite end of the cue-ball line is always determined, however, by subtracting two from the number for the near end, and counting back from the other end of the table for the resulting number. Thus the number-three cue-ball line, after subtracting two from three, should end at the first diamond on the opposite side.

The fascination of pool and billiards is largely due to the mathematical exactness with which the most erratic-appearing gyrations can be duplicated time and again by an expert player. Masse shots, at which Horemans, the Belgian player, is an expert, often apparently defy all the laws of reasonable conduct. A masse is a curved ball which starts in one direction, changes its mind and ends up somewhere else, like a boomerang. When young Schaefer won the title from Willie Hoppe, he was forced to use one of the most difficult of all masses, with all three balls in line along the rail, the two object balls being so close together that it was impossible to hit the first and send it out at an angle while the cue ball would follow through to complete the point by hitting the second. Instead Schaefer massed the cue ball out in a curve that circled around,

Two Difficult Fancy Shots, a Three-Cushion Kiss Shot off the Red Ball, Above, and a Three-Cushion Time Shot, Below, Demonstrated by Al Taylor, One-Time Challenger for the World's Balk-Line Championship

International Billiard Tournament Staged in a San Francisco Church Auditorium; Huge Galleries of Billiard Fans Gather Each Year to Watch the Ranking Stars Play for the Title

came back, struck the farthest object ball and glanced on to the nearest one. The shot, as Schaefer played it, is illustrated in the center picture on page 631, while, just below and to the right, is the simpler form, where the distance between the balls is sufficient to drive the first one out of the way.

Many of these complicated shots require intricate "bridges" formed by the fingers. Schaefer is noted for the perfection of his bridges, his long flexible fingers bending easily backward, but steadying in the most difficult positions and holding there without a tremor while the shot is being made.

Schaefer's history is the story of a young man who followed in his father's footsteps so well that he has won the same championship, the world's balk-line title, which, incidentally, is no empty honor since it is worth $6,000 a year to the holder. It also carries with it exhibition tours and special opportunities for demonstrating one's skill, all of which pay well.

The elder Jacob Schaefer was one of the first great billiard players and did much to establish the position of the game. His son, born in 1894, was only 27 when he defeated the veteran Willie Hoppe for the title by running up a grand average of $51^{10}/_{13}$ points to an inning, which almost reached the record of $55^{15}/_{27}$ which Hoppe had set seven years before.

How far billiards have advanced in the five years since Schaefer won his first title is indicated by the fact that he averaged 93¾ for sixteen innings, when he defeated Horemans in January of this year, while even the loser beat Hoppe's old record by a fraction of a point.

Schaefer has set many records in tournament play, but one of the most unusual was during the 1925 tournament, when he eliminated Hagenlacher by the unique score of 400 to 0, his opponent never having a chance to climb down from his stool and try his luck. Schaefer won the bank at the start and ran out the 400 points without a stop.

In the closing game of the tournament, which marked Hoppe's retirement, Schaefer again made a remarkable run of 296 points.

The skill required to make several hundred successive plays without faltering is enormous, and the nerve necessary to do it before a crowded auditorium of wildly enthusiastic billiardists still greater.

His coolness served Schaefer well in his

last match with Horemans, who is inclined to be excitable, but failed to help him the month before when the challenger won the title. On that occasion Horemans got away to a good start, and the champion was forced to sit on his stool most of the evening. At one stage, the Belgian had run up a score of 467 to 11, but Schaefer finally got started and collected 301 before his opponent was able to run out the 500 score for the evening.

The men who become champions, or of sufficient caliber to play in championship games, have a remarkable mastery over the ivory balls. Perfect balls on a perfect table always perform the same way under given conditions, so there is no uncertainty about the expert's shots. Some of the fancy shots, rarely seen in tournaments, are marvels of accurate timing, two or three balls in motion meeting at predetermined positions to touch and rebound on new courses, whence they strike other balls to complete the shots.

In one shot, for example, the white cue ball, lying against the red object ball, drives the latter down the table, to rebound from the end cushion and strike the cue ball, which in the meantime has remained almost motionless because of backspin applied by the cue. The cue ball, rebounding from the returning red ball, makes three cushions and eventually strikes the second of the object balls near the other end of the table. The whole shot, taking a matter of seconds, is so accurately timed that a billiard expert can perform it over and over again.

The old-time pool room with its unsavory reputation has been largely eliminated through the efforts of the billiard manufacturers and state organizations, and both straight and pocket billiards, once threatened with general disfavor, put back on a higher plane. One result of the change is the growing popularity of billiard rooms devoted exclusively to women.

FABRIC FOR CHASSIS BEARINGS MAINTAINS OIL FILM

Bearings of a fiber composition instead of metal for the auto brake gear, steering and suspension system, and other parts, are said to be a suitable substitute for bronze or white metal, to keep an even lubrication and, even when not oiled, produce little frictional resistance. The material is capable of withstanding a pressure of two tons to the square inch without perceptible yielding, it is reported. The composition is not intended for highly important engine bearings, which are all inclosed and highly lubricated, but especially for the minor parts of the chassis, where heavy loads are borne, adequate lubrication is difficult and squeaks and rattles are likely to arise.

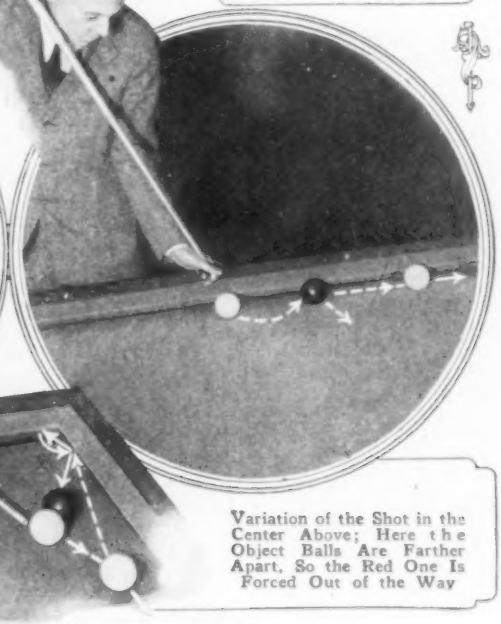
Billiard Parlor for Women Only. One of the Newer Developments of the Game Which Has Found Favor in Larger Cities, Where Both the Pocket and Cushion Game Have Many Feminine Followers

Al Taylor Showing How to Make a Three-Cushion Shot off One Rail, a Difficult Feat Which Takes the Amateur Many Long Hours of Practice to Master

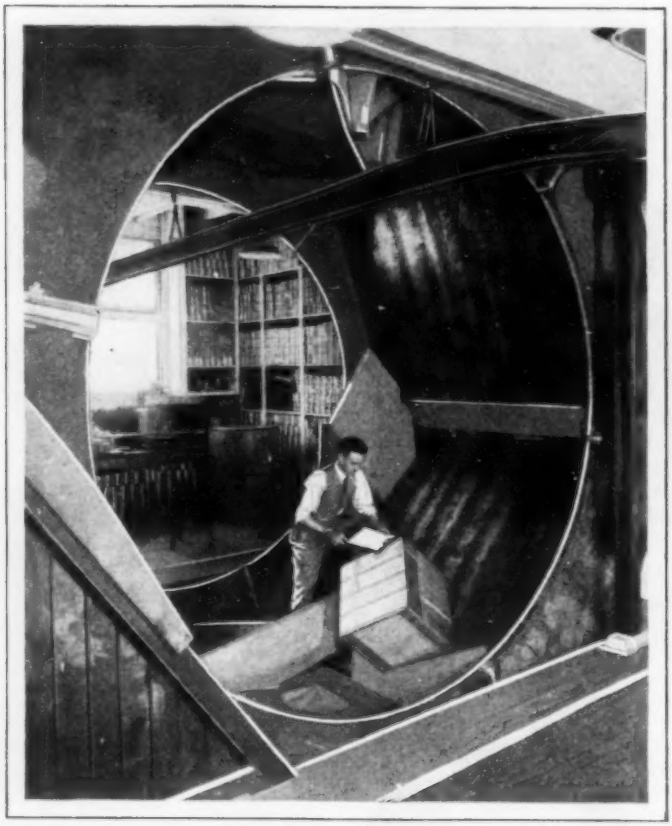
Masse Shot off the Farther Ball, Requiring Perfection of Bridge, Knowledge of "English," and Iron Nerve

Three-Cushion Masse, in Which the Back-Spinning Cue Ball Makes Two Cushions on One Rail and the Third on the Other before Losing Its English

Three-Cushion Draw Shot, Using Reverse English, the Ball Making All Three Cushions in the Corner after Rebounding from First Object Ball



Variation of the Shot in the Center Above; Here the Object Balls Are Farther Apart, So the Red One Is Forced Out of the Way



As Boxes Bump About in This Revolving Drum, Weak Spots Are Revealed; These Tests Show Shippers the Most Durable Containers

STRENGTH OF SHIPPING BOXES TESTED IN WHIRLING DRUM

What kinds of boxes will best withstand the strain involved in shipping? Railway freight and express representatives, meeting at the forest-products laboratory at Madison, Wis., were given graphic tests of the strength of different kinds of crates and boxes by means of a six-sided drum, fourteen feet in diameter. Containers of various types were placed inside this receptacle which was revolved slowly. Bumping around obstructions placed inside of the drum and over its irregular surface, the boxes received shocks and jars more than equal to those met in actual shipping. Weak spots were revealed and improper methods of filling the crates also disclosed.

SHIP'S SPEED LIMIT RULED BY COAL

Coal, and not entirely the limitations of a vessel's propelling machinery, determines the speed at which it can operate with any hope of commercial gain, according to experts, who believe that the speed limit so far as passenger liners are concerned has about been reached. This is because of the enormous increase in the amount of coal required as the speed is accelerated. For instance, a ship of 16,000 to 18,000 tons' displacement, when running thirteen knots an hour, will burn ninety tons of coal a day, but if the speed is increased to seventeen knots, the consumption of fuel rises to approximately 190 tons of coal each day. At twenty knots, the speed of a fast Atlantic liner, nearly 345 tons would be required, and at twenty-five knots, over 900 tons a day. From thirteen knots to fourteen knots an hour, the extra cost for coal would be only about $340, or so, for each 1,000 miles, but at twenty-five knots the cost would be $1,500 more than at twenty-four knots. A vessel of 18,000 tons' displacement, running at twenty-five knots, would consume approximately 1,500 tons of coal for each 1,000 miles.

FLINT GUN FOR LIGHTING GAS SAVES USING MATCHES

The hazards and bother of using matches to light the gas are eliminated in a pistol-shaped igniter that directs a hot spark from a flint upon the burner by pressing a trigger. New flints can be inserted when needed, the lighter is always ready for use, and is harmless.

Gun for Lighting Gas; Pressure on Trigger Causes Sparks to Fly from Flint

¶Brazil's area approximately equals that of Europe.

JAPAN CURRENT IN NEW PATH ALTERS HABITS OF FISH

At first thought, there seems to be no direct connection between an earthquake and the fish market, but apparently there is. Shortly after the Japanese earthquake of 1923, the Japan current strayed into new courses, taking its warm waters into different parts of the ocean. According to Alaskan herring fishermen, this has materially changed the temperature of the waters near the coast, and as a result fish have been forced to find new havens.

MUCILAGE HOLDER AND DAUBER COMBINED

Waste and sticky fingers are avoided when using mucilage with a combination holder and spreader which fits inside a metal-topped desk stand when idle. The adhesive is kept in an inverted glass bottle and flows through small openings in a coarse fabric stretched over the smaller end. The container itself serves as a dauber, even spreading is possible, and the need of repeated dipping of a brush is eliminated.

Dauber in Use and Placed in Stand

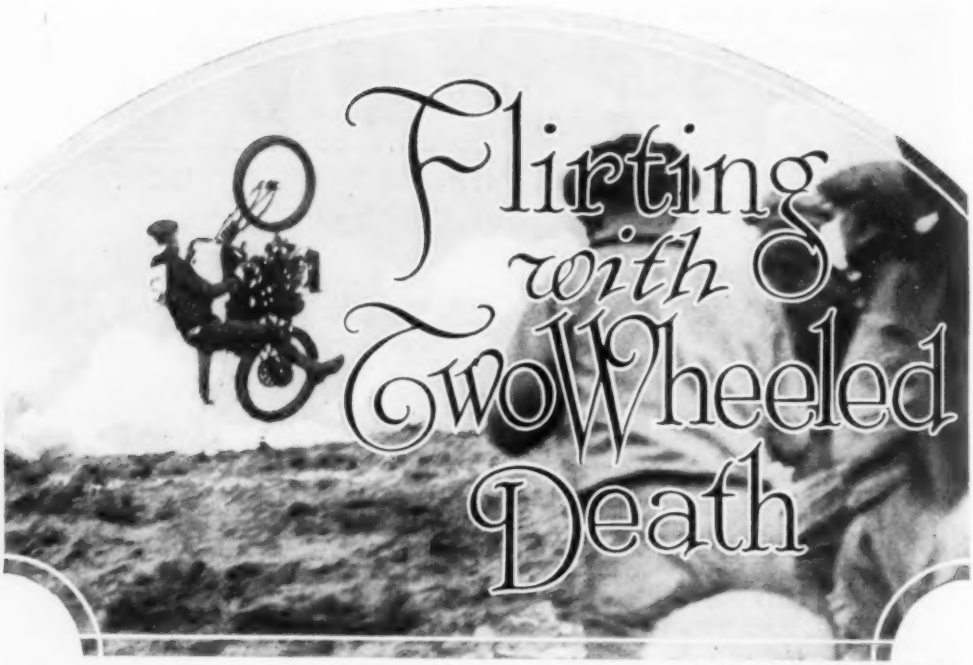
AUTO-PARKING SPACE ON ROOF RELIEVES CONGESTION

A flat-topped building has been utilized for automobile-parking space in Washington, D. C., to accommodate owners who work near by and to reduce congestion in the streets. The aerial garage is reached by a freight elevator which opens upon the roof; there is room for several cars, and the plan prevents theft as well as damage from collisions that might happen if the cars were left on the streets.

Out of the Way and Safe from Thieves; Autos Parked on Roof of Washington, D. C., Building

SCREEN IS DARK HALF OF TIME MOVIE IS BEING SHOWN

Few motion-picture fans realize that they are looking at a dark screen nearly half the time the reel is being shown, but such is the case, according to a well-known photographer. Furthermore, each one of the tiny pictures that make up the reel, is seen three times. In front of the projection machine's lens is a revolving disk divided into six parts, three being sections through which the light is allowed to travel to the screen. By a synchronizing system, this disk revolves once each time one of the little pictures, of which there are sixteen to every foot of film, stops before the opening. Thus there are three showings of each one of the views before it passes on to the next. The solid portions of the disk, shutting off the light, keep the screen in darkness about half of the time, but the entire action is too rapid for the eye to detect. In filming a recent movie, 120,000 separate pictures were taken, making a reel 7,500 feet long.



Flirting with Two Wheeled Death

Courtesy Harley-Davidson Motor Co.

Daring Hill Climbers, Devotees of Motordom's Most Thrilling Sport, both Ride and Are Ridden by Bucking Mounts

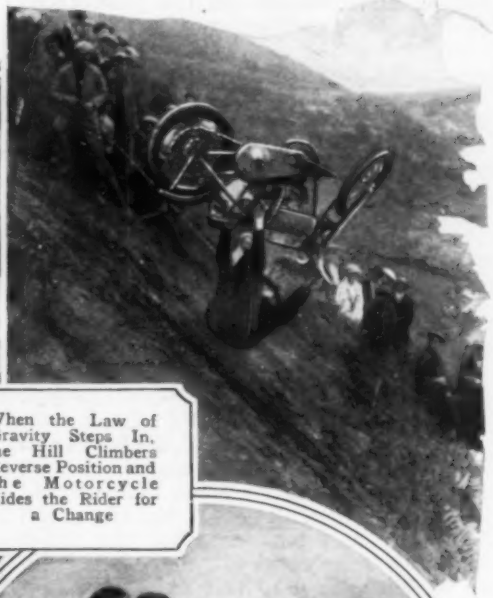
RIDING several hundred pounds of ninety-mile-an-hour motorcycle up a forty-five-degree slope, until the hill gets so steep the motorcycle reverses position and climbs on top of the rider, is not everybody's idea of a pleasant afternoon. But there are enough who get a thrill out of the most dangerous sport in motordom to make such climbs the most favorite form of outing for every motorcycle club that can find a suitable hill within a day's ride of home.

That hill-climbing is more dangerous even than automobile racing is not hard to prove. The auto racer has a sporting chance of escaping with a whole skin and on all four wheels. The motorcyclist who goes in for hill-climbing hasn't a chance. Somewhere between top and bottom there is bound to be a spill, and when the rider lands on his back, juggling a snorting racing machine in the air above him, there is bound to be some damage to skin and, possibly, bones.

Freak stunts and spectacular races have been featured so much that the average person has the idea that anyone who rides a two-wheeler is taking his life in his hands. Motorcycle men say not, and declare their mount is as safe as the old-fashioned bicycle, unless the rider deliberately goes a-stunting. The motorcycle thrillers shown in the movies are not lightly undertaken by every two-wheel rider, any more than all of them go in for hill climbs. The motorcyclists who appear in the movies are usually trained stunt men who well realize the hazards of the work, and are prepared, through training and cool nerves, to cope with the dangers which threaten serious injury or death.

The hill-climb riders are usually professionals, many of them demonstrators for factories or agents, and they enter the contests not only to demonstrate their own skill and provide thrills for the spectators, but to show the power of the machine they ride. With a dozen or more trained riders entered, thousands have assembled to watch them send their mounts up hills where they defied the law of gravity, up inclines so steep that they could hardly be negotiated on foot.

Under such conditions it is not unusual to see the weight of the rider on the rear end overbalance the machine, sending it into a back somersault from which it emerges with the driver on his back on the ground and the machine trying to



When the Law of Gravity Steps In, the Hill Climbers Reverse Position and the Motorcycle Rides the Rider for a Change

Practicing a State Fair Thriller, Above, in Which the Motorcycle Passenger Transfers to the Rope Ladder from Above; Right, a Movie Stunt Not Recommended for Everyday Practice

After Riding down the Long Hill in the Background, This Man Injured Himself to Save a Woman and Child

fall on him. Sometimes the motorcycle, with engine roaring, escapes and runs wild down the hill, chasing innocent spectators through the fields. Often, however, the trained rider not only gets control, cuts off the motor, but actually eases the machine to the ground and averts a bad smash-up.

One Pacific coast dare-devil recently departed from the usual custom of a free-for-all climb and went out alone to conquer a mountain peak in the Rockies. His route lay along a narrow ridge of loose shale and rock slides, with sudden washes and canyons at intervals, and an enormous precipice under his elbow. The grade was too steep to try to take it at slow speed, so he simply gave the machine the gas and dashed through.

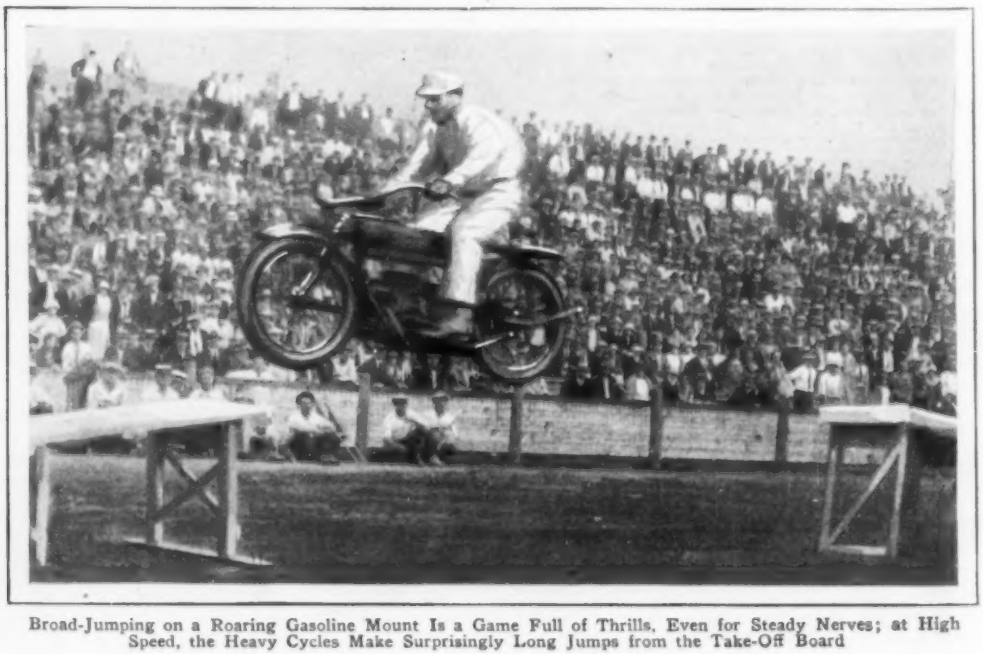
Steele, of Paterson, N. J., a noted eastern hill climber, staged an unexpected thrill in a climb at Pompton Plains, N. J., a few years ago. The hill was about 500 feet long and ten feet past the finish line was a bank about four feet high. In practice, he used this bank as a stop by sliding broadside into it.

"Everything went along fine until I took my first trial in the seventy-four-inch open event," Steele later said. "I had not turned my motor wide open in practice, so, when I started up the hill in the trials, I turned it all on and held tight. Before I could realize it, I was at the finish and the crowd did not expect me there so soon. The result was that I had no chance to broadside into the bank, but had to ride straight over it to avoid running into the people.

"I hit the top of the bank and flew straight into the air over the bars and landed on my face. The machine turned a somersault and, as I looked up it flopped toward me. Luckily for me my mount proved loyal, for it finally landed right alongside of me. Except for a scratched face and a stiff neck for a few days I was all right."

Next to climbing of hills, motorcycle broad-jumping leads in thrills for the spectator, and danger for the rider. It was widely practiced during the war by army messengers, who learned to take an old trench line or a shell hole in high and leap the gap. Given a slight incline to launch the machine in the air, a motorcycle going at full speed will jump anywhere from twenty-five to fifty feet, soaring in an arc twenty feet or more above the ground and coming down, perhaps, on two wheels or, as an alternative, spilling the rider in the dust. A Canadian rider, Morris Moffatt, holds a world's record for motorcycle broad-jumping, with a 210-foot leap from shore into the icy waters of Lake Ontario, while a tug stood by to rescue him.

One of the most sensational motorcycle stunts ever staged for the movies cost R. B. Parrish two broken legs, the



Broad-Jumping on a Roaring Gasoline Mount Is a Game Full of Thrills, Even for Steady Nerves; at High Speed, the Heavy Cycles Make Surprisingly Long Jumps from the Take-Off Board

sult of saving the lives of a woman and child who stopped in his path. Parrish undertook to ride the rounded top of a steel aqueduct which supplies water for a Pacific coast city. A long stretch of the huge pipe was built on top of the ground, then it dropped to the ground level and gradually disappeared beneath the earth. Parrish balanced his machine on the few inches of comparative flatness on top and started out to ride down the long incline which led from the hill to the valley where the pipe went into the ground.

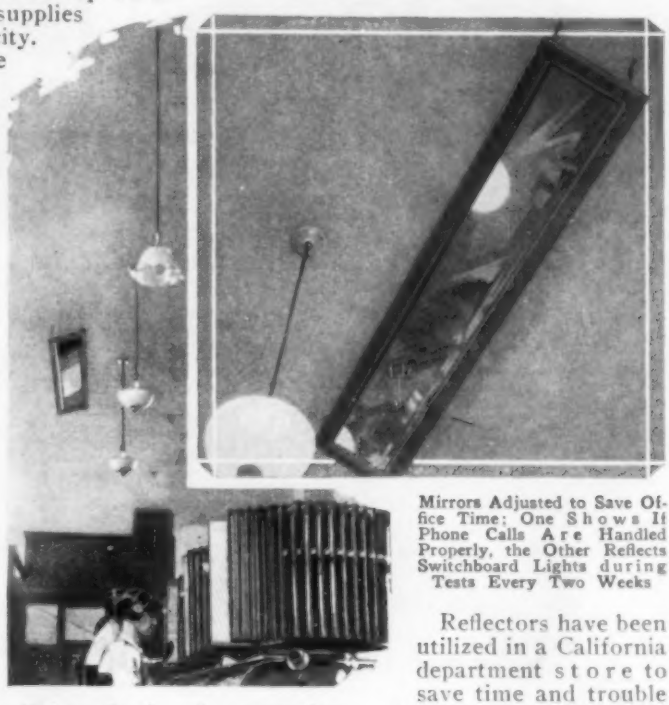
With movie cameras clicking, the machine was making terrific speed when, as Parrish neared the end of the trip, the woman and child walked into view and stopped in astonishment as they saw the machine coming down the top of the pipe. Too startled to move, they stood helpless in the rider's path. There was no chance to stop, since the slightest hesitation meant a slip over the side.

Parrish solved the problem by turning his front wheel to the side and deliberately dashed off into space. The machine crashed to the ground, breaking both of the rider's legs.

TUBERCULOSIS CURE SOUGHT IN CHEMICAL AGENT

Search for a chemical substance that can be harmlessly introduced into the body to destroy the tubercle bacillus is being conducted by a western physician. He discovered, after injecting tuberculosis germs into the veins of subjects, that, three to eight weeks later, by far the greater amount was in the lungs. In the majority of cases, the liver was comparatively free from disease, indicating, he believes, that the organ contains a chemical that will throw off the bacilli.

MIRRORS SPEED PHONE CALLS AND AID LIGHT TESTS

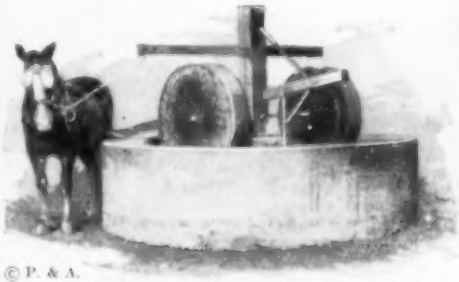


Mirrors Adjusted to Save Office Time; One Shows If Phone Calls Are Handled Properly, the Other Reflects Switchboard Lights during Tests Every Two Weeks

Reflectors have been utilized in a California department store to save time and trouble in operating a telephone switchboard. One of the mirrors is so adjusted that, by merely glancing at it, the manager can see if calls are being handled efficiently. Another is attached to the ceiling, to facilitate the testing of lights on the phone panels. This is done by "shorting" the lamps one at a time on a test board behind the wall. The electrician sees in the mirror if the lights flash properly.

BLINDFOLDED HORSE PROPELS OLD-TIME OLIVE-OIL MILL

Largely to please its native Italian patrons, a large California olive-oil company uses, at one of its mills, an old-fashioned crusher such as has been employed for centuries. It consists of two huge granite wheels which are revolved over a circular vat of olives by horsepower. The animal is blindfolded to keep it from straying from the ring.



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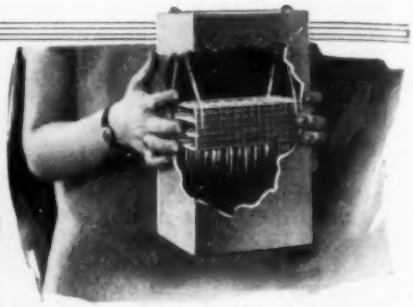
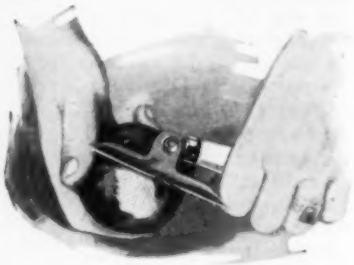
Crushing Olives in Old-Fashioned Mill, Two Granite Wheels Propelled by Blinded Horse

Time and Money-Saving Tools

Protected against Soiling, a Roll of Wax Paper Is Inclosed in Metal Reel Attached to Wall, Where It Is Handy for Wrapping Lunches and Other Uses



Flour Is Thoroughly Mixed with Other Dry Ingredients and Sifted Eight Times through Four Screens in This Simple Shaker



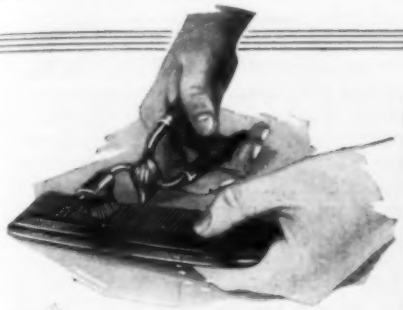
For Left-Handed Persons Especially, This Adjustable Paring Knife Simplifies Work, Cuts Slices of Uniform Thickness and Also Takes Out Cores

Removing Eggs or Other Foods from Frying Pans Is Often a Ticklish Job, but This Broad-Bladed Knife Is Easily Slipped Under, and Its Sharp Edge Will Cut Bread; at the Left Is a Double-Compartment Bucket Formed by Detachable, Semi-circular Lining; Hot Water May Be Poured in One Side and Cold, Clean or Soapy Water in the Other; the Inner Unit Has a Flap to Hold It in Place and to Aid in Removal

Besides Holding Four Spools, This Rack Has a Notch to Cut Thread

Anyone wishing further information on devices described in the editorial pages can

for Woman's Workshop in Home



Operated Like Scissors, Comb Cleaner with Detachable Brush Reaches between the Teeth

Pudding Cooker Saves Time and Requires No Cloth; Dough Seals the Lid

Measurements Are Marked on Black Edge of Tape and Then Rubbed Out

Glass Top on Roaster Becomes Platter for Serving Fowl or Other Meats; Round Corners Permit Easy Cleaning

Paper Pie Plates Instead of Tin, Can Be Thrown Away after Baking to Save Washing

Spring Clip on Cake Knife Permits Removal of Pieces without Breaking or Dropping, and Does Not Soil the Fingers

obtain it by addressing Bureau of Information, Popular Mechanics Magazine, Chicago.

BEAUTY PARLOR FOR PET DOGS PREPARES THEM FOR SHOWS

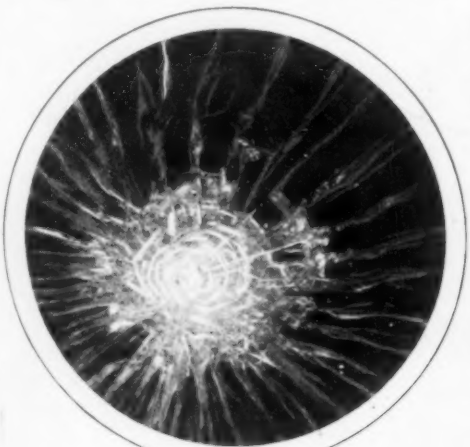
Dogs of all kinds are given the latest styles in canine shingles, shampoos and

White and Long-Haired Dogs Need Special Grooming, and Canine Beauty Parlor Is Equipped to Give It

foot treatment at a special beauty parlor maintained in connection with a hospital in Boston, Mass. When the pets are to be entered in shows, they receive make-up and powder, if the owner desires. Clippers and other instruments are included in the equipment of this institution.

BULLET-PROOF GLASS RESISTS POWERFUL GERMAN PISTOL

Recent tests with bullet-proof glass have shown that the material will not only turn large-sized bullets from U. S. army automatic pistols, but also smaller and more penetrating missiles from the Mauser weapon of German make. A bullet from one of these revolvers will penetrate eleven pine boards, while the U. S. automatic is effective through eight, but the glass turned the smaller lead, permitting it to enter not more than one-eighth of an inch into the surface of the material. A metal-jacketed bullet was turned completely inside out and welded upon the surface of the glass in one of the tests, and a second shot failed to pierce the specimen. The impact caused a series of cracks, but these were not considered serious as the target, composed of alternate layers of glass and a transparent fibrous material, did not break. A cartridge from a Springfield rifle was also turned back, although the force of the shot pulverized the outer coating of glass and the bullet apparently was vaporized. Layers of the target were separated in a circle six inches in diameter around the point of impact, and this space was filled with a thin layer of lead which evidently had been condensed from the vapor. The glass is widely used for windshields, and windows of tellers' cages and pay cars.



Cracked but Not Broken, a Specimen of Bullet-Proof Glass after Being Struck by Two Lead Missiles

SUEZ CANAL BEING ENLARGED TO MEET SHIPPING NEEDS

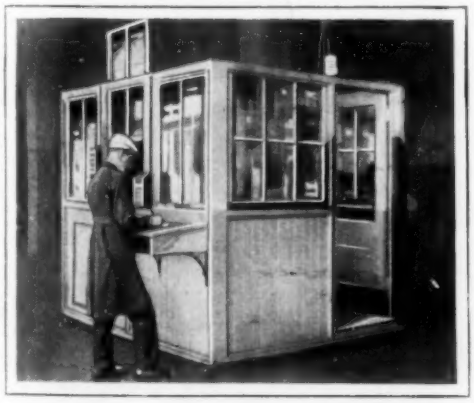
Because steamers are larger than they used to be, engineers are at work on the Suez canal, enlarging the channel so that this important traffic link may better serve the needs of commerce. Originally, the bottom width of the canal, which is 104½ miles long, was seventy-two feet and its depth only twenty-six feet. Later, this was increased to thirty-six feet and the present excavations, when finished, will insure a depth of not less than forty feet, while the bottom width is to be extended to 300 feet and the minimum surface width to 440 feet. Steamers with a draft of thirty-three feet will soon be able to use the waterway. A maximum of thirty-one feet is the present capacity. The trip through the canal takes sixteen hours and about fifteen ships use it every twenty-four hours. Some 4,600 craft are accommodated yearly, representing a net tonnage of more than 22,000,000. Unlike the Panama canal, Suez has no locks. The banks are surfaced by rocks quarried near by. At Port Said, large workshops, which employ more than 1,200 mechanics, are maintained to repair tugs, dredges and floating cranes.

RABBITS CURED OF DIZZINESS BY REPEATED SPINNING

By making them dizzy for brief periods each day, rabbits tested by Prof. Knight Dunlap, at Johns Hopkins university, gradually became accustomed to the treatment and showed no effects from the spinning and cold-water applications to the ears by which the dizziness was produced. The experiments indicated that the semicircular canals of the animals' inner ears, and other organs by which the balance is maintained, became adjusted to the whirling. This supported what already had been found in the case of men tested for admission to aviation. It was discovered that candidates need not necessarily be rejected because their heads swam after being spun around in a chair, for it was shown that they could become accustomed to the unusual motion. According to Prof. Dunlap, his experiments emphasize the complication of the apparatus which controls the equilibrium of the body and suggest lines of further research.

PORTABLE OFFICE ON CASTERS SAVES STEPS IN SHOP

Portable offices that can be rolled to different parts of the floors of a large automobile shop in San Francisco have proved timesavers to employes and customers as well. Each is supported on four casters, has glass windows on all sides, while electric wires are provided with plugs for quick attaching to new sockets when the location of the office is changed. The telephone cable is carried on a roll which can be unwound when the "cage" is in transit.



Portable Office in Use; Windows on All Sides Afford View of Shop, and Desk Aids Patrons

Model of Proposed Rescue Fire Truck with Platforms to Reach to Buildings Extended

FIRE TRUCK WITH PLATFORMS TO AID IN RESCUES

To help firemen rescue persons trapped in buildings, an eastern inventor has prepared a model of a truck which carries a series of steps on an extension frame and also platforms or landings which may be extended to the windows or other entrances to structures. They serve as bridges, making it unnecessary to lean the ladders against the building and helping to prevent falls. The entire apparatus folds up when lowered, and is raised with power from the motor.

BLACK RASPBERRIES ARE WHITE ON FREAK BUSH

Having lost the faculty of supplying color, a black-raspberry bush, grown by a Canadian fruit producer, developed white berries. The vine was a seedling and grew to about twice the size of the other bushes. According to a horticultural expert, colorless or white fruit from both the red and the black raspberry is sometimes found as a result of plant-breeding work. If vines producing these white berries were isolated from others, it is believed their fruit would continue to breed true to type, reproducing the white or "sport" berries.

CLENCHING OF FISTS SHARPENS MENTAL ACTIVITY

Many persons knit their brows or clench their fists instinctively when trying to concentrate closely. Tests at the University of Chicago show that such actions help the thought processes. There is, apparently, benefit in muscular and mental co-operation. While squeezing a pair of handgrips similar to those used in athletic training and examinations, a young woman student demonstrated that she could pass tests in addition, memorizing and perception much more efficiently than when her muscles were relaxed. The gripping proved especially helpful in tests where great speed, rather than accuracy, was required. The explanation, scientists say, is that when the muscles are tensed, the person is wider awake than when they are relaxed, hence his mental powers are sharpened.

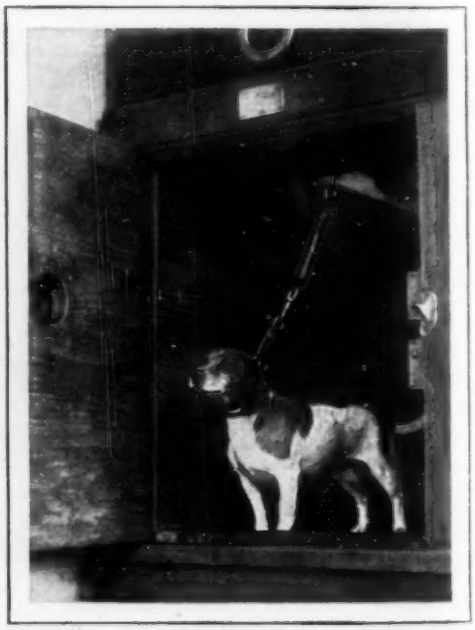
Demonstrating the Effect of Clenched Hands on Thought; the Young Woman Grips Handles While Responding to Memory and Other Tests of Mental Alertness

NECKLACE OF CAVE-BEAR TEETH CLUE TO LOST ATLANTIS?

From one of the deep limestone caves of southwestern France has come a curious relic that points to the mysterious land of Atlantis, the partly mythical continent mentioned by Plato and for which search has been made for centuries. The trinket is a necklace, believed to have adorned some mighty hunter of the Magdalenian period some 25,000 years ago. It was brought to this country by Dr. George F. Collie of Beloit college, who has succeeded in piecing it together and tracing the supposed connection it bears to the lost land. The necklace is composed of four cave-bear teeth, each almost three inches long, a section of the spine of some fish, sixteen inch-long shells, shaped like elephant tusks, and two other units, similar to small ordinary shells. The presence of these shells in the necklace is of special interest to the scientists, for they suggest a cult that has been traced back to Spain where it evidently was borrowed, many centuries ago, from a land that lay to the west, the supposed location of the lost continent. The same art was also acquired by the Egyptians, who obtained it from a region of which there is now no trace, scholars assert. Dr. Collie holds that it is possible that the shell art may have originated in Atlantis, which is now supposed to be submerged in the ocean as a result of a great upheaval of nature.

DOGS KILLED IN ELECTRIC BOX TO PREVENT SUFFERING

When dogs must be killed at the Cincinnati pound, an electric chair dispatches them quickly and without unnecessary suffering. The apparatus consists of a small compartment and a coil of wire for the electric current at the top. This is fastened to a collar strapped about the dog's neck. The charge is turned on automatically when the door is closed.



Awaiting the Fatal Electric Current; Charge Is Released When Door Is Closed on Dog

SIXTEEN carloads of educational inventions have latterly completed extensive tours aggregating 70,000 miles and have been viewed with great interest by more than 5,000,000 spectators, which indicates how admirably Uncle Sam's latest strategy is working—he is spreading science's story by getting the people to look even though they will not listen.

To prepare educational exhibits in novel form has been one of the department of agriculture's difficulties, and to make the visualization so vivid and spectacular that it will put across its scientific information in an understandable and attractive manner has been another. But by employing experts and inventors to study and produce; by hiring designers, mechanics and artists to make the resultant models and exhibits, and by displaying these original masterpieces at state, interstate, national and international fairs, expositions and congresses throughout the country, the authorities are consummating remarkable achievements.

The shadow-screen system, operated with a sequence of floodlights, is a recent innovation from Uncle Sam's workshop which has added a new and outstanding chapter to the history of sight-of-eye education. If you recall how you have stood outside of the screened window of a darkened room and were unable to see within, although, when inside the selfsame room, you could readily see out, you will understand the working principle according to which the shadow-box exhibits are run. Say, for example, that the educational exhibit consists of three sequence pictures which are shifted by changing lights so rapidly that your eyes almost undergo an optical illusion. Two of these pictures will be painted on sets made of window screen. The third picture will appear on the rear wall of the shadow box. By alternately switching on and off the floodlights which illuminate each picture, the effect is similar to the finest motion-picture production, only more spectacular.

One of the kingpin shadow boxes portrays the tale of the neglected campfire which kindles the neighboring forest and results in a million-dollar woodland fire. The first picture shows the abandoned fire left by some hunter or motorist. A heavily wooded slope adjoins the picturesque valley where the few last embers smolder. The next picture explains how a sudden breeze fans the embers into a flame and spreads sparks to dry forest cover, so that a raging fire speeds up the mountain slope, ruining valuable timber and causing wild game to flee before its van. The third scene features despoilment and desolation with only charred and smoking stumps left to tell the tale of what somebody's carelessness accomplished.

Automatic electric controls govern the shadow-box pictures. The pictures are so nicely dovetailed together that one fades into another. Light and motion are used most skillfully to produce the desired effect—an effect which blends together so well that the spectators look around for a projection machine and wonder how the startling colors are secured. The effect of motion is obtained by weathervane-like devices, operated electrically,

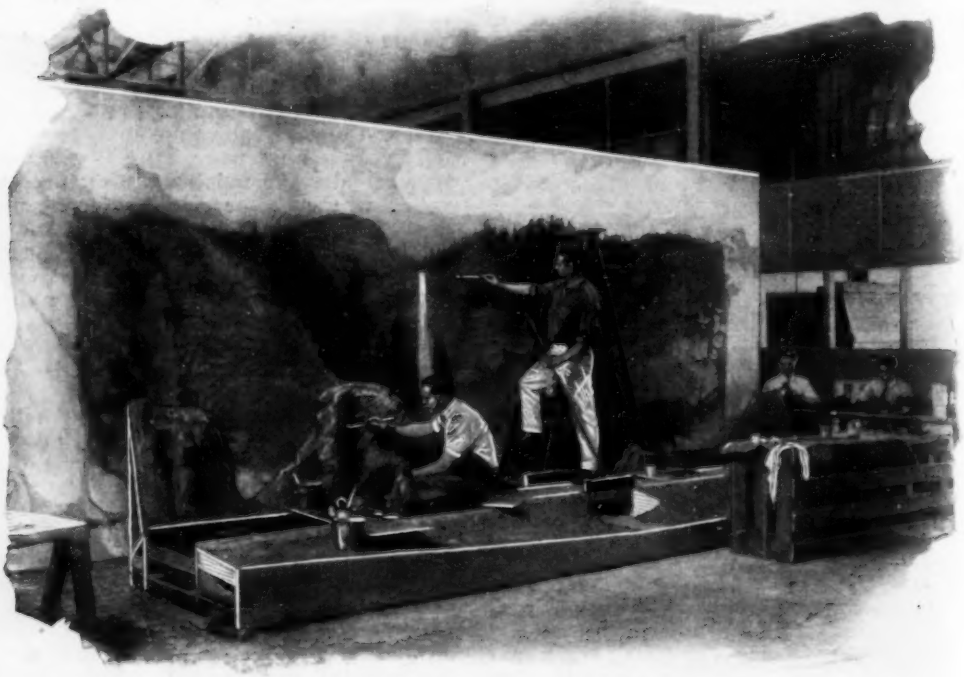
to cast moving shadows so as to simulate flames burning or smoke rising.

A mechanical cow is another exhibitional marvel which the office of exhibits at Washington has originated and perfected. The effigy is lifelike and true to size. It was made from the bromide enlargement of a Guernsey cow's photograph. This great picture was secured in position on a composition-board frame. An expert artist then colored it. A skilled carpenter sawed the figure from the frame. He mounted it so that it stood alone. In this day and age, when living live stock are displayed in hotel lobbies and assembly halls, a life-size model of a cow does not arouse much interest, no matter where it is shown.

Our national representatives pondered, scratched their heads and finally evolved the idea of equipping the cow with visible circulatory and digestive systems, which would simulate the functions of these vital organs in life. One side of the cow's overcoat was cut away. A hot-water bottle was camouflaged as a heart. Small rubber tubes were provided as artificial veins and arteries. A carefully adjusted and perfectly timed pump was used to make the bogus heart pulsate regularly and to cause the uniform dilation and contraction of the arteries and veins. Yes, here was something astonishing which made the crowds stop, stare and study.

Wherever this mechanical cow was exhibited, it was the center of educational interest. Thousands of dairymen and farmers have said after studying the fine exhibit, "This is the first time that I have been able to understand exactly how the cow makes milk from her blood." In terse, understandable language, the activities of the cow's vital organs were explained on poster panels placed directly behind the model. This exhibit puts across the object lesson of science in a spectacular manner. The model was so instructive and accurate that the Texas agricultural college has made an exact replica which is now used for demonstrational work before the veterinary classes at that institution.

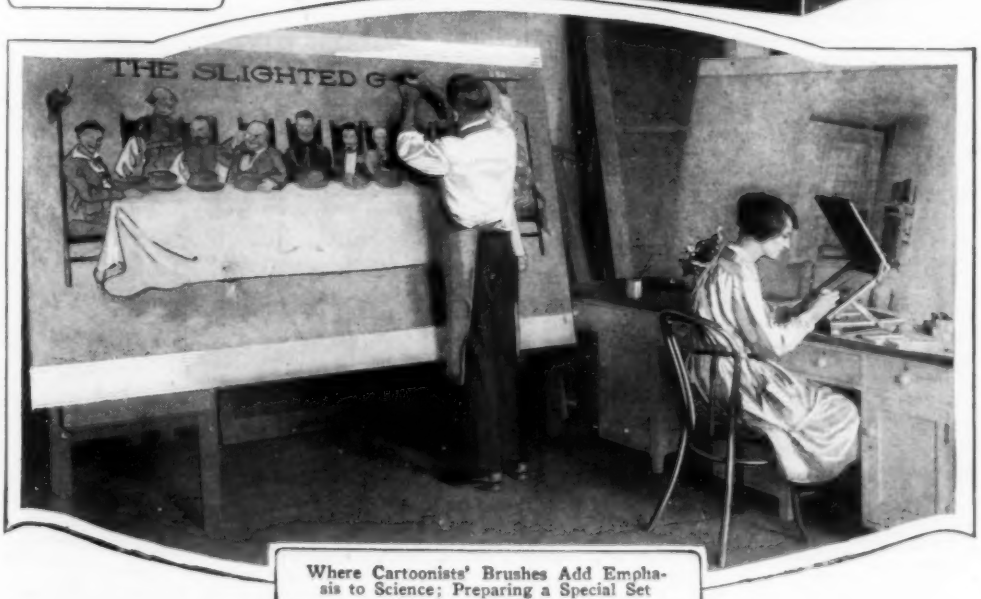
The venerable poultry story of how better breeding and feeding will invariably be reflected in increased egg yield has also been told in a new language via mechanical hens. Here again, inventive genius has been capitalized to aid educational agriculture. Lifelike models of two hens were made. By harnessing electricity and mechanical motion, the federal inventors produced a pair of fowl



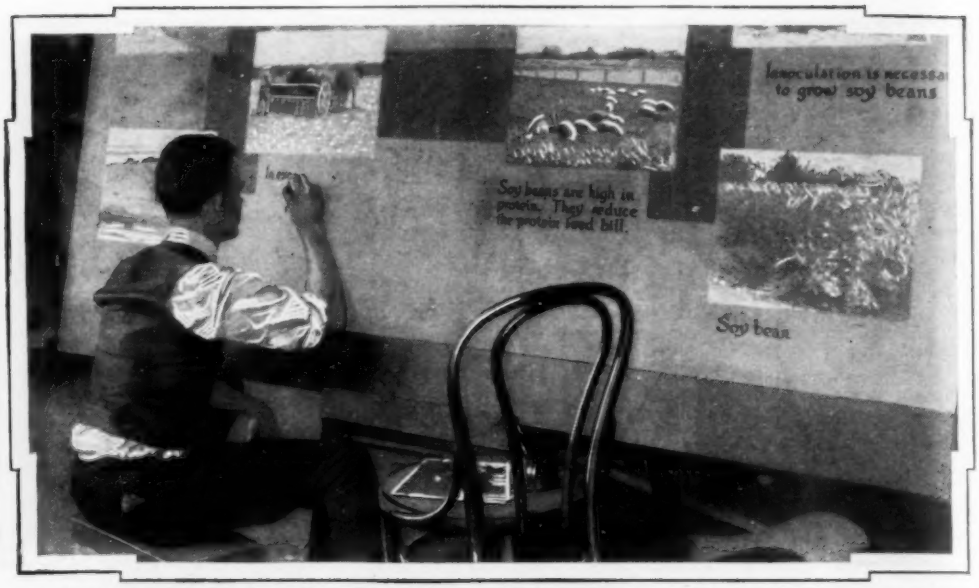
Uncle Sam's Artists Painting a Background for One of the Educational Exhibits; Like Stage Scenery, the Pieces Are Constructed for Convenient Shipping When the "Science Show" Takes to the Road

Illustrating Helpful Messages for the Nation's Farmers; Sketches Are Prepared from Photographs of Actual Scenes, and Charts Impress the Lessons

What Is a Good Plan to Follow in Constructing a Dairy Barn? A Government Exhibit Endeavors to Answer the Question in a Detailed Model, Showing Practically Every Item



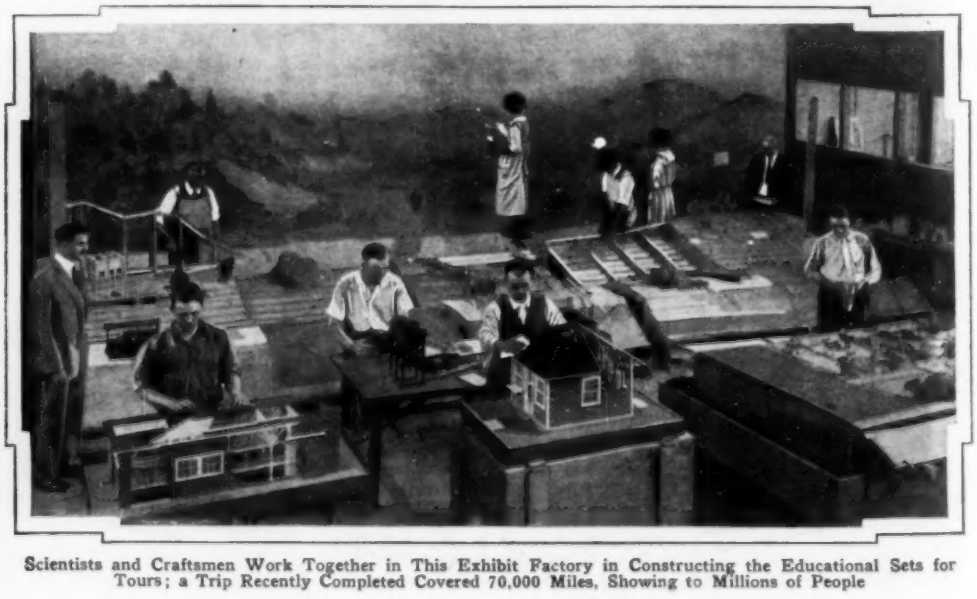
Where Cartoonists' Brushes Add Emphasis to Science; Preparing a Special Set



"A Good Picture Is Worth 10,000 Words," Declares a Chinese Proverb; Believing This, Government Artists Adapt the Most Effective Illustrations Available for the Educational Panels

which would crow, flap their wings—and lay eggs at regular intervals. One of the birds, as shown by her conformation, feathers and general appearance, was better bred than the other. The egg-laying apparatus of this hen was geared so that it would deposit twice as many eggs in a given period as its mate.

A scoring device was placed above each nest and count was recorded of the number of eggs which each fowl laid. The arrangement was such that each egg, as deposited, slid through a hinged aperture in the nest into a basket below. This sensational poultry show was so unusual that everybody who passed would stop to look. Many interested in egg production would remain to study and reflect. Strange to tell, visual exhibits of this type have converted many food producers to new methods who would never pay any attention to printed discussions.



Scientists and Craftsmen Work Together in This Exhibit Factory in Constructing the Educational Sets for Tours; a Trip Recently Completed Covered 70,000 Miles, Showing to Millions of People

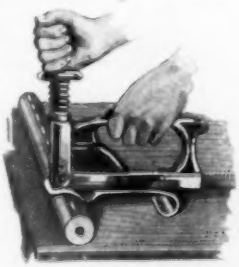
A puzzle latterly confronted Uncle Sam's exhibit makers. They needed some artificial grass to use in a steer-feeding demonstration. They hunted high and low, but found that artificial grass was apparently as scarce as bathing suits at the North Pole. Where do you think they finally found what they were after? In an undertaking establishment. The grass mats which the undertaker places over the newly filled grave were just the thing. These mats are made of raffia—an imported palm-tree product—which can be dyed any color and is fastened securely to a burlap base.

Time was when the exhibits which you saw at fairs, shows and expositions, consisted almost entirely of photographs and displays of grains, grasses, fruits, farm products, and the like. Recently, Uncle Sam has instituted remarkable reforms. He has hired some of the country's best talent to originate and perfect scientific shows which will arouse universal interest. Congress has supported the revised program admirably. Special workshops, art studios and warehouses are now used exclusively for these displays.

Many of these exhibits consist of hinged panels upon which are painted the figures of animals, men and farm scenes. All these panels are made of composition board, which is light, durable and easy to handle. The arrangement is such that the same panels can be used year after year by merely changing the pictures or models.

STAPLER FOR ROLLER SHADES SAVES TIME AND WASTE

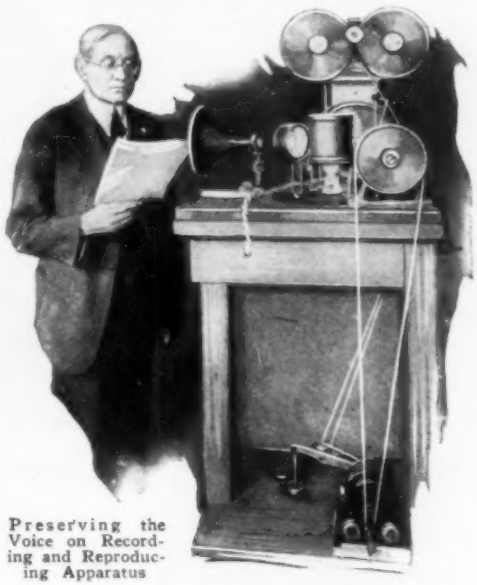
Shade cloth is attached quickly and neatly to rollers with the aid of a stapler that has a curved extension on one side to hold it on the center. Staples are inserted by pressing down on a plunger bar, and they are connected in a strip of seventy-seven placed in a magazine which can be refilled in three seconds. There is little danger of tearing or cutting the cloth with this stapler; it is not necessary to hold the roller with the hands while tacking, and the outfit weighs but two pounds.



¶ From twenty-five to twenty-eight miles an hour is the average speed of most of the varieties of smaller birds.

REPRODUCER OF SOUND WAVES PRESERVES TONE QUALITY

For recording and reproducing sound, an apparatus developed by an engineer of the General Electric company is reported to be greatly superior to the radio or phonograph. Tone quality is preserved and a wide musical range can be registered, it is said. The process used is somewhat like that employed with talking motion pictures, the voice or other sound being caught on a film, then reproduced by the action of sensitive cells.



Preserving the Voice on Recording and Reproducing Apparatus

PER CENT OF CARBON IN COAL CLUE TO OIL DEPOSITS

The ratio of fixed carbon to the total combustible matter in coal is an index as to the probable presence and depth of oil or gas accumulations, according to G. F. Moulton, of the Illinois geological survey. Coals mined in that state were found to have a fixed-carbon content varying from forty-nine to sixty-three per cent of the total combustible matter, while most of the oil comes from areas in which the carbon ratio lies between fifty-four and fifty-seven per cent. The reason for this relationship is that heat and pressure conditions which affect the accumulation of oil, change the composition of the coal. In areas where the carbon ratios are above sixty per cent, the oil and gas possibilities are poor, while the lower the ratios, the greater the chance of striking oil.

NAMING BUGS AND BEETLES WOMAN'S ODD JOB

To the lay mind a beetle is a beetle, but to the scientist its species is extremely important for study and classification. Identifying and naming insects from all over the world is the difficult and unusual task of Miss Elenora T. Armstrong of the Smithsonian Institution. If a specimen is sent in as a new one, it is part of her job to examine it carefully and search records to see if the beetle or bug really is a new find, and if it is, she devises a suitable name which will meet the needs of scientific classifications and accurately describe the subject.

Miss Armstrong and Sample Case of Beetle Specimens at Smithsonian Institution; Insects Must Be Correctly Named and Classified

BAD VENTILATION FOUND TO BE COMMONEST CAUSE OF COLDS

To find better preventive methods, doctors in recent years have been studying the common cold more carefully than ever, and two authorities have summarized the supposed causes of this affliction under five headings: chills and drafts, conditions of the weather, irritation of the membrane on the breathing apparatus, infection and bad ventilation. The last is regarded as the commonest of all the causes, as warm stagnant air produces congestion and swelling in the mucous membrane which becomes covered with a thick secretion and affords a weak spot for germs to attack. In cool air, this membrane remains taut and well moistened. Then, in a poorly ventilated room, cold currents of air are likely to strike the feet while the head is exposed to the warm, polluted upper atmosphere. This is just the reverse of what is considered the ideal condition for health, "cool breezes blowing around the head, the radiant heat of the sun and a warm ground to stand on." Exposure alone will not cause colds in healthy individuals, the doctors declare. Arctic explorers, fishermen, and others who remain out of doors for long hours in stormy, cold weather, often seem immune from these disorders. Irritation of the mucous membrane of the respiratory passages by dusts and chemicals is also a common cause of colds.

POLICE WEAR COLORED LIGHTS FOR NIGHT TRAFFIC WORK

Human "lighthouses" will aid night-faring motorists and pedestrians in New York under the plan of John A. Harriss, special deputy police commissioner. He has ordered a special equipment of green, red and yellow lights, operated by push buttons and worn on the traffic policeman's chest, as an amplification of the signal tower's service to travelers. The colors mean "Go," "Stop," and "Get Ready" as in the stationary beacons, and since the policeman usually stands in a conspicuous place, there is less chance that his lights will be obscured. The plan also will save installing signal posts at intersections where a traffic guide is needed only on occasions.

Turning Policemen into Traffic Towers; Set of Colored-Light Signals for Directing Night Travelers

How to Improve Your Set

By F. L. BRITTIN

NO radio receiver is perfect; some approach perfection, but the large majority fall far short of the mark. The ideal receiver is still in the dim future: no science stands still and radio least of all. It is yet in the experimental stage in many respects, although the progress made in the last few years has been phenomenal. No matter what type your set is, many simple additions or corrections can be made that will improve the tone quality, selectivity, range and volume. These improvements, however, need not be of an expensive nature, if you study your own set and locate the imperfections. A word of advice is pertinent here. Do not listen to the say-so of every "expert" who comes along; his experience may have been with an entirely different type of set, and the remedy suitable for one circuit may be entirely wrong for the same symptoms in another.

There are several general rules to follow for best results that apply to all sets, such as well-constructed aerials, efficient grounds, and good batteries and tubes. We will not go into these general details as they are taken as a matter of course. The efficiency of any set is limited by the surrounding conditions, including atmospheric disturbances and interference from all sorts of electrically operated devices and power lines. These disturbing elements all work against good reception, no matter how excellent the set may be. The set itself, on the other hand, must not contain elements that add to the difficulties to be overcome.

Selective and easier tuning is an important factor in crowded cities, as the 10-kilocycle separation of wavelengths allotted by the government to the broadcasting stations is not sufficient to make tuning easy in locations where several stations are grouped together. Interference between stations having similar

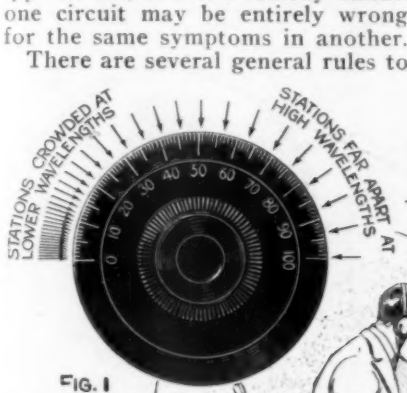


FIG. 1

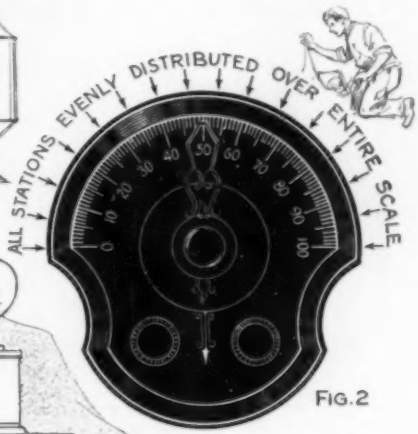


FIG. 2

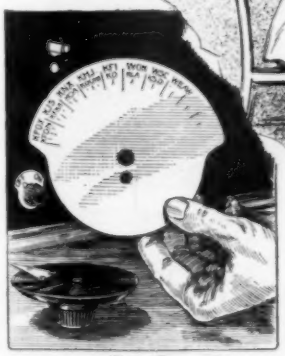


FIG. 3

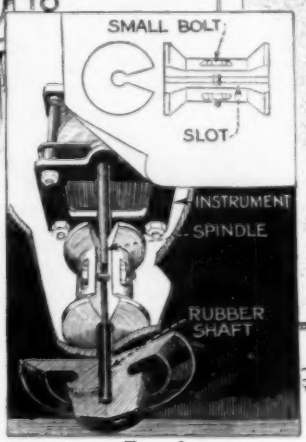
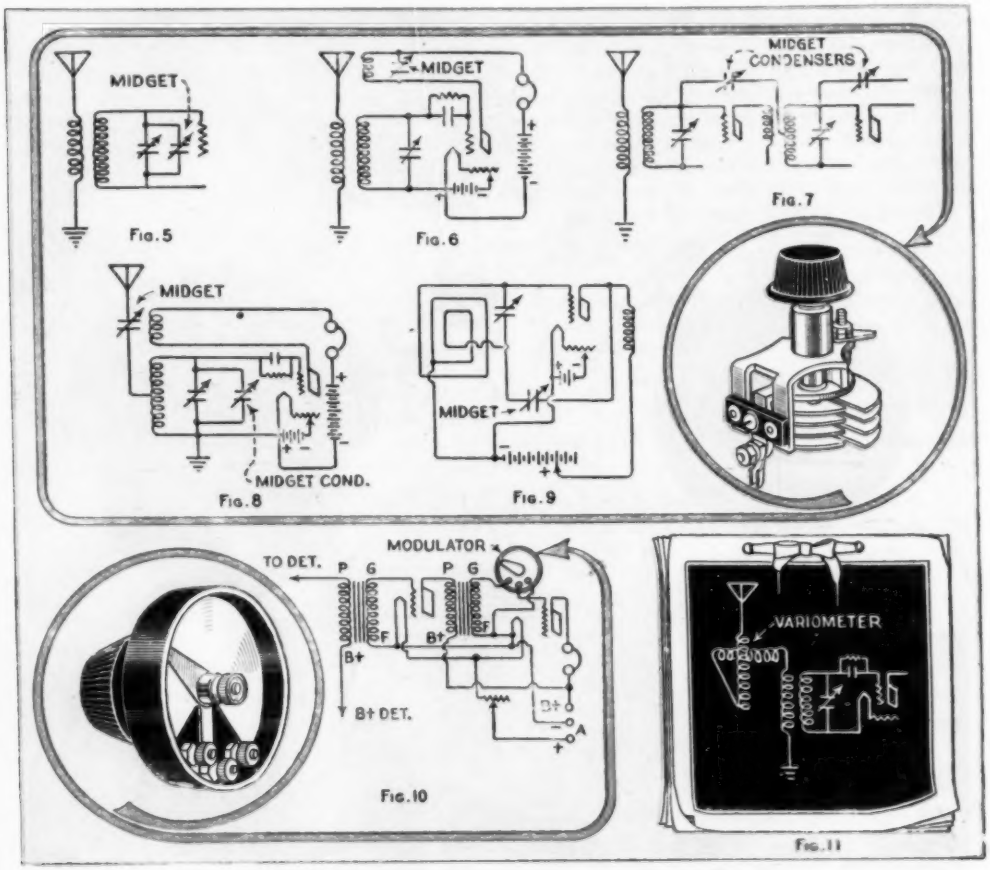


FIG. 4

wavelengths also often defies separation, although the stations may be hundreds of miles apart. Radio designers and manufacturers are striving to remedy the condition, and good progress has been made. Straight-line-frequency condensers, when used with the proper coils, have made possible a wider separation of stations over the dial. The crowding of the low-wavelength stations on the lower half of the ordinary dial with the common type of condenser is illustrated in Fig. 1. Many who have sets equipped with this type of straight-line wavelength condensers do not care to discard them, and the set, even if this is desired, may be so designed that it is not practical to install the new straight-line frequency type. Several manufacturers, therefore, are bringing out special dials that will make the common condenser approach the same result (see Fig. 2). This is accomplished by means of an ingenious arrangement of two gear trains, or a similar mechanism, within the front plate of the dial. The two trains move in such a way that, while one moves a pointer at a regular rate over the graduated scale of the dial, the other train rotates the condenser. This latter gear train works in such a way that, at the lower readings, the condenser moves faster than the pointer, causing the stations at the crowded low wavelengths to be separated on the scale and bringing the stations of higher wavelengths closer together.

A homemade logging plate is shown in Fig. 3, which can be placed behind the ordinary dial and is a simple aid in tuning. A disk of aluminum is cut in the form shown, and is fastened to the panel by means of a locknut or screws. The disk should be large enough to extend above the dial when in position, giving space for writing in the call letters of the various broadcasting stations. Tuning is often made difficult by body capacity; a station is tuned in and when the hand is withdrawn from the dial it is gone. There are several ways of correcting this de-

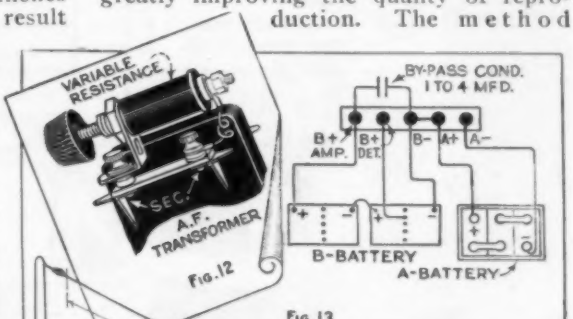


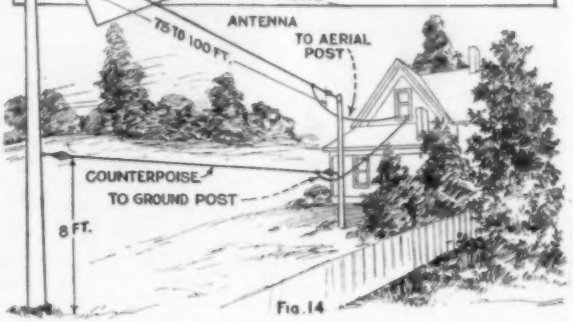
fect; a simple method is shown in Fig. 4, in a case (a very common one) where the live shaft of the condenser caused the trouble. A wooden spool was used to form a collar for a hard-rubber extension rod, and the condenser was remounted on the bakelite subpanel several inches back of the front panel, with the result that the hand capacity disappeared. Other methods of correcting hand capacity are grounding the rotor plates of the condenser, and shielding the back of the instrument panel.

One of the simplest ways of improving the set is the intelligent use of a midget, or balancing, condenser; there are a number of these little condensers now on the market similar to the one shown in the inset illustration under Fig. 7. They are very useful for vernier action, for neutralizing and for capacity regenerative feedback. The capacity of these condensers is very low, and the construction is along low-loss lines. Fig. 5 shows one of these little condensers used as a vernier on a large condenser; Fig. 6 shows an ideal method for obtaining vernier control of regeneration by tuning the tickler coil of the three-circuit tuner with the midget condenser. For those who have tuned r.f. sets not neutralized, or have old-type inefficient neutralizing condensers, the midget is a valuable addition to the set; Fig. 7 shows the usual method of neutralizing the tube capacities.

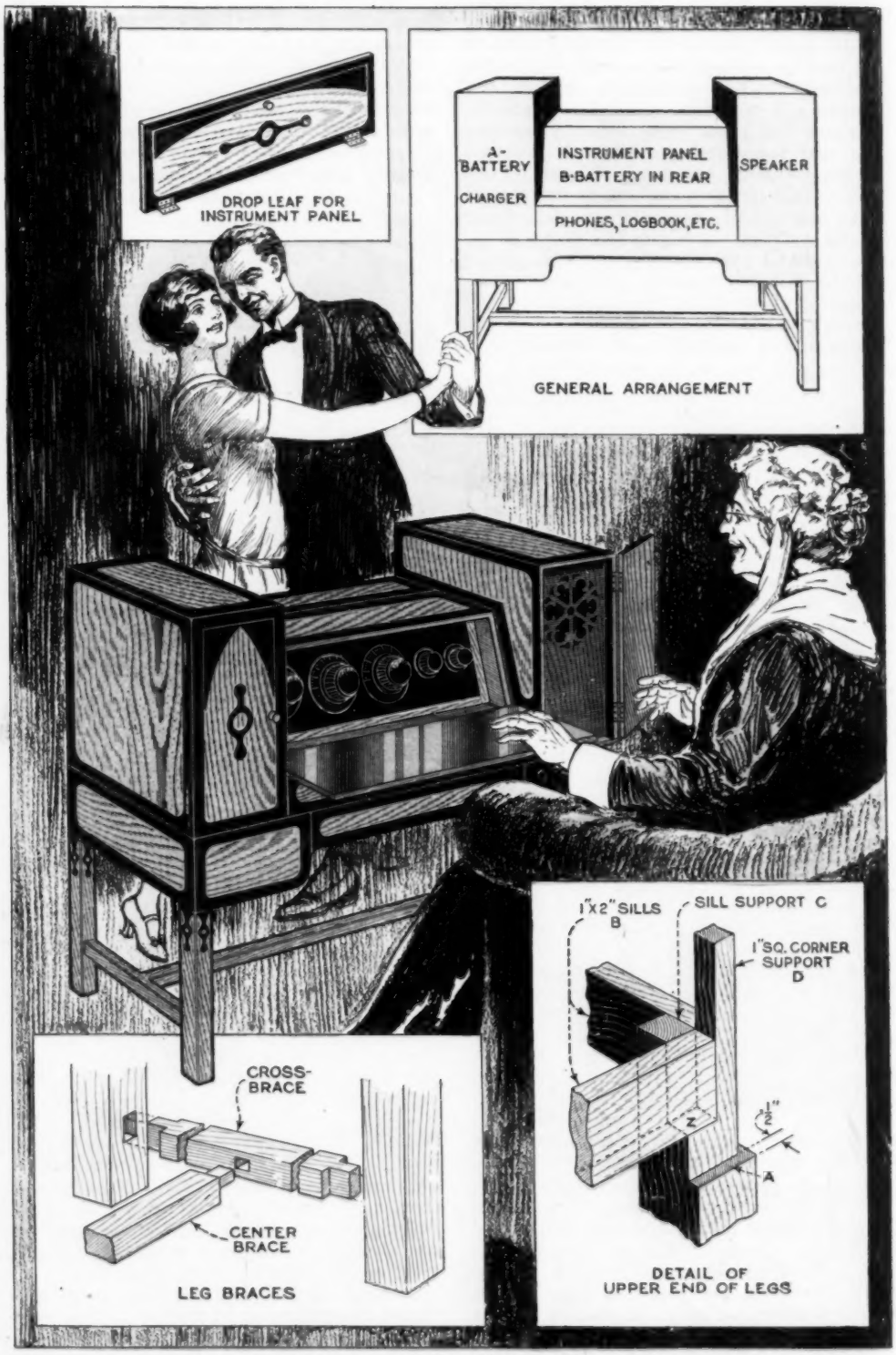
Those who would like to experiment with capacity antenna coupling, and the use of a vernier across the grid-tuning condenser, will find a wiring diagram in Fig. 8. Adding regeneration to the loop on tuned r.f. sets and superheterodyne receivers means better distant reception, and will appeal to all DX fans; Fig. 9 shows the method and the midget condenser turns the trick.

Volume control is a point sometimes overlooked in these days of fewer jacks, and the tendency to eliminate as many controls as possible. There are two very easy methods of controlling volume and tone quality by the addition of simple and inexpensive instruments to the set, as shown in Figs. 10 and 12. The instrument shown in the insert in Fig. 10 is a non-inductive variable resistance of the same general constructon and appearance as a potentiometer; this instrument is known as a modulator, and its resistance can be varied from zero to 500,000 ohms. When connected in the audio-amplifying circuit, as shown in the diagram, the modulator gives noiseless adjustment to any desired tone volume, from a whisper to maximum strength, greatly improving the quality of reproduction. The method shown in Fig. 12 is similar, but the instrument is here connected across the secondary of the last r.f. transformer, and consists of a variable resistance ranging from 10,000 to 120,000 ohms; it can also be used in resistance-coupled amplifiers.





If your receiver does not cover the broadcast wave bands as well as it should, the addition of a variometer in the aerial circuit, as shown in Fig. 11, will often give the desired result. If the set is noisy, this can often be remedied by the use of a by-pass condenser across the entire B-battery, as shown in Fig. 13. This condenser should be as nearly perfect as possible, and the larger the better; if defective, it will only make matters worse. Good sets often give poor results due to an inefficient ground. This is especially true in dry, sandy localities; the counterpoise ground shown in Fig. 14 will be found a decided improvement and costs very little. It is an exact counterpart of the aerial above it and the lead-in is taken to the ground post on the set. This type of capacity ground should be in general use, as, in most cases, it is more efficient than the ground available.



Various Details of Design of the Radio Console Cabinet, and Drawing of the Completed Cabinet, Showing Decorative Scheme

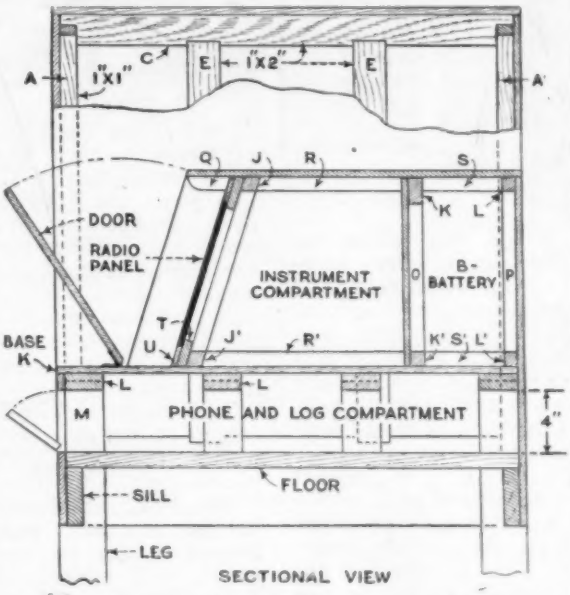
How to Build a Radio Console

By HERBERT C. McKAY

RADIO is universal, but its development has been largely that of efficiency. Appearances have been left to care for themselves with the result that today the radio set in most American homes means a small square cabinet, A, B and C-batteries standing upon the table near by, a loud speaker on top of the set, while logbook, phones and similar articles decorate the landscape. The home mechanic who is even moderately skillful in the use of tools, however, may assemble his own set and inclose it in a cabinet, at a total cost of less than $100, even in the case of the multi-tube sets.

The dimensions and even the details of design of the cabinet will vary with the different sets, so no exact measurements will be given. The drawings and text will give the reader sufficient information to enable him to build the cabinet which suits his particular set.

The set from which the drawings were taken was built to accommodate an 8 by 28-in. panel. The instrument inclosed was a five-tube, tuned radio-frequency set. The batteries used were one 6-volt, 100-amp.-hour storage battery, a Tungar charger, and two 45-volt B-batteries. The latter were of the upright, heavy-duty type. The speaker was of the paper-cone type. As this type of speaker is not as common as the horn type, two extra drawings have been included to show how to adapt the horn to the cabinet.

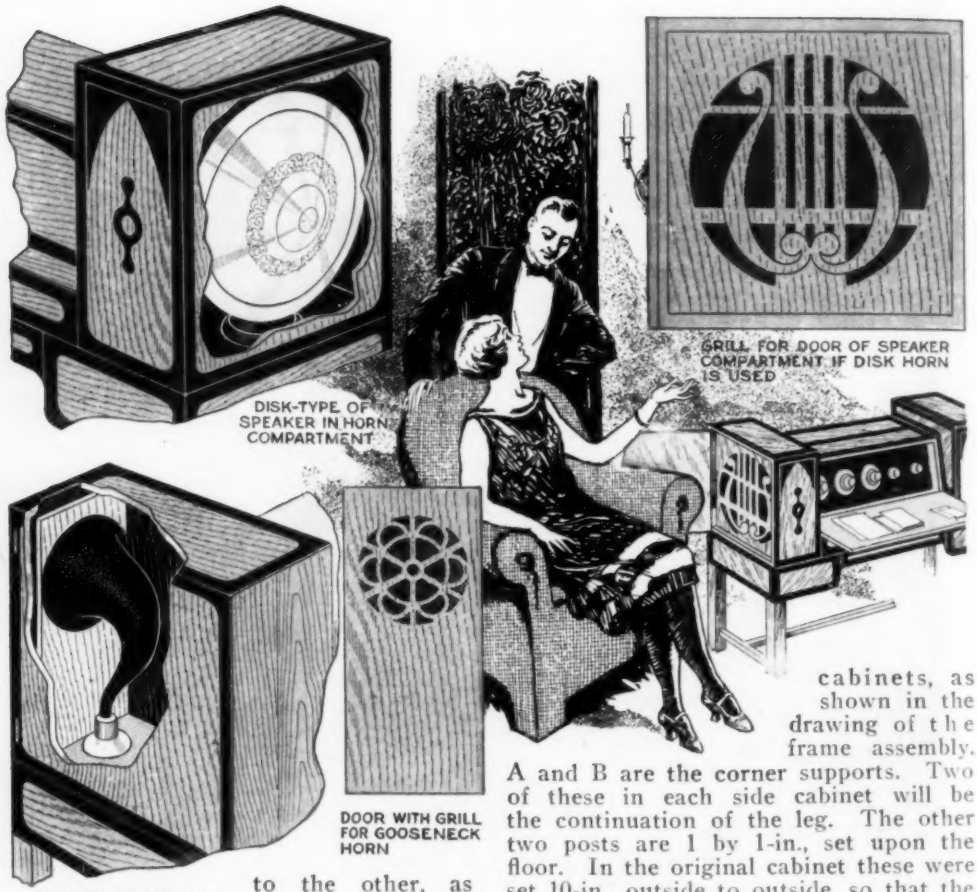


SECTIONAL VIEW

The full-page cut shows the front of the finished cabinet. The two-tone effect adds greatly to the homemade set. This finish may be secured in different ways. For example, the cabinet may be stained mahogany, the design then painted in with enamel, and the whole varnished. Another way is to stain the cabinet, then buy wood-grained paper such as is used by decorators and cut the design from this paper. In this case, the edges of the designs are painted black and the whole glued to the panels. A coat of varnish completes the work. These methods are makeshifts, however. For a really good job, the panels should be finished with cut-out designs in relief. For this work a thin veneer is obtained. Spanish mahogany from a cigar-box factory will serve beautifully. The designs are cut out, and laid out upon the panels before the cabinet frame is assembled. Then the legs are recessed deeply enough to compensate for this added thickness. In this case, the designs will appear as relief carving, with the contrasting tone to add attractiveness. The slight extra work will repay the builder well.

The first step is to construct the framework. The legs are cut from material 3-in. square. The two front legs may differ from the rear ones, depending upon the finish of the rear of the cabinet. If it is to be a four-square job, completely finished, all legs will be made as shown for the front legs, while, if the rear is to have a rough finish, the rear legs will be made as shown in the lower figure, detailing the legs. The difference between the two is only that, in the latter case, the legs are not recessed upon the rear side for the paneling. The perspective shows the construction clearly. First the ½-in. recess, A, is shown. The paneling sits flush in this recess. Above this are shown the recesses for the two 1 by 3-in. sills, at B. A portion, C, of the leg post is left to support these sills, while above is a 1-in. square of the original post, D, which supports the corners of the end cabinets.

Another detail shows the construction of the leg braces. Short crossbraces connect the two pairs of end legs, while a single center brace extends from one end


DISK-TYPE OF SPEAKER IN HORN COMPARTMENT
GRILL FOR DOOR OF SPEAKER COMPARTMENT IF DISK HORN IS USED
DOOR WITH GRILL FOR GOOSENECK HORN
GOOSENECK HORN IN POSITION

to the other, as shown. By careful mortising and the use of both screws and glue, this construction will prove to be adequate. The frame is now assembled. The braces will support the legs at the bottom, while the sills will support the top. These sills may be 1 by 2, 1 by 3, 1 by 4-in., or a combination, depending upon the size of the cabinet and the material used. The original cabinet had 1 by 3-in. sills of oak.

The next step is to insert two extra braces, as shown in the detail of the frame ready for flooring. One is a center sill, and the other is an added sill across the battery compartment to support the extra weight at that end. This view shows paneling in place for a rough-finish rear, while the drawing below shows the paneling for a finished rear.

The frame is now floored with ceiling material, or regular flooring. This is cut flush with the sills, so that the paneling will cover the edges of the flooring boards. The next step is the framing of the end cabinets, as shown in the drawing of the frame assembly. A and B are the corner supports. Two of these in each side cabinet will be the continuation of the leg. The other two posts are 1 by 1-in., set upon the floor. In the original cabinet these were set 10-in., outside to outside, so that the application of the ½-in. plywood paneling make these end cabinets 11 in. wide, outside measurement. A stronger construction is obtained by notching the floor and extending these end supports to the sills, as shown.

Two pieces of 1 by 2-in. stock are then cut, as shown at F, and set upon the end posts. Then two pieces, C, are cut and placed for the top-side supports. Pieces, 1 by 1-in., as shown at G, are set between the posts upon the floor. Now braces, E, are set upon the inner sides of the end cabinets for added support. This completes the framing of the side cabinets. The next step is to apply the panels on the inside of these cabinets. This is necessary, as the framing of the radio cabinet proper is secured to this paneling.

The frame-assembly drawing shows the completed framework, except that these two panels have been omitted for the sake of simplicity. It is to be assumed that these panels are in place between

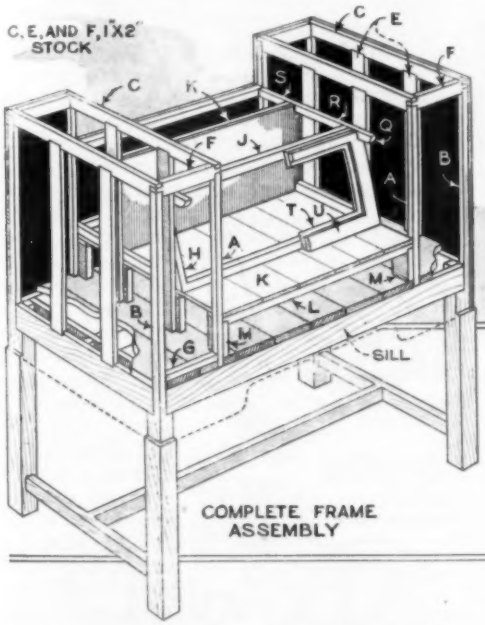
the framing of the end cabinets and the radio cabinet itself. End supports, M, are cut 4 in. long, and beams, L, secured to them. Upon these, the radio-cabinet floor, K, is laid. This should be one piece in front of the panel, in order that the best finish may be obtained.

Referring now to both sectional view and frame-assembly drawing, bottom beam J^1 is laid in. Then lower beams, K^1 and L^1, are laid in place and secured. Next, uprights, H, O and P, are secured to the paneling of the side cabinets. Upon these are laid the upper beams, J, K, and L, as shown. Then cross beams, R and S, are secured to the side panel, as are the corresponding lower cross beams, R^1 and S^1.

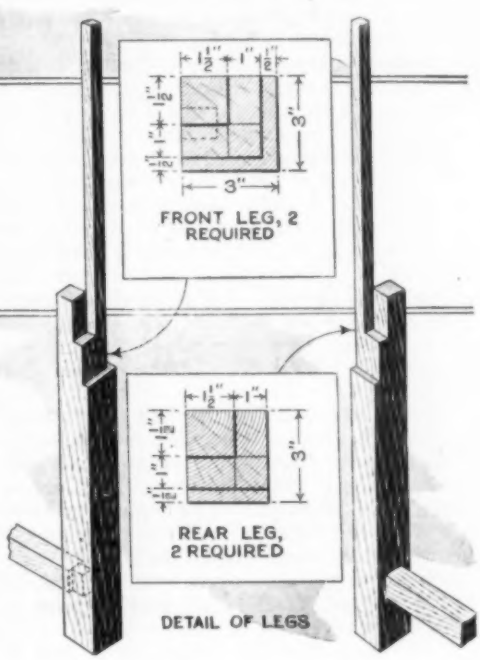
The panel supports, T, are now placed in position. Uprights are not needed here, although they may be added if desired. To these are secured the panel-frame members, U. These members should be the thickness of the panel and 1 in. wide. These form a support and frame for the panel, giving a more finished effect than if the panel completely filled the cabinet front. It may be said here that the sloping panel is used only for the improved appearance. The upright panel is just as easily added. The partition between the instrument compartment and the battery compartment is placed against uprights, O, and beams, K and K^1. Now the top support, Q, is attached to the cabinet panel, and the radio compartment is ready for covering. This cover may be hinged in the middle, which gives a more symmetrical appearance, or it may be hinged at the upper beam, K, for easier access to the instrument compartment. The front door, which is hinged at the bottom, may be left to the last step.

The paneling is now applied. The end-cabinet doors may be hinged as best pleases the constructor. In the original cabinet the end doors, the square ones, are hinged at the top. As they are seldom opened, this makes the natural position the closed one. Also, in the original, the front panels of these compartments were fixed in place. This was due to the fact that the non-directional disk speaker was employed. For the horn, it will be necessary to make a speaker panel in the front of the speaker compartment, and this compartment must have a door to open this panel to the room. This door may be hinged at the inside, or it may be hinged to the larger door. In this case, opening the larger door will also lift the front door and expose the whole compartment.

In the original cabinet, the 18-in. disk speaker occupies a place as shown in the perspective detail. It practically fills the compartment. This cabinet is placed so that the speaker compartment faces the longer open side of the room. In

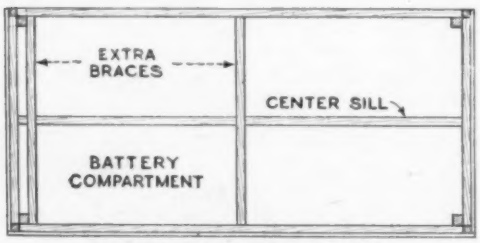


COMPLETE FRAME ASSEMBLY

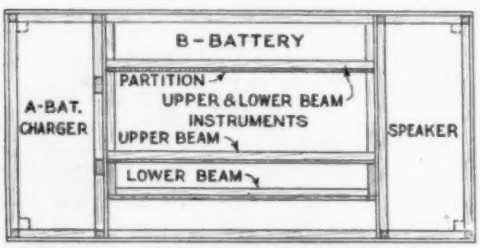


DETAIL OF LEGS

the door of this compartment a design was fret-sawed, as shown. This was lined with brown silk. Thus, the reproduction from the hidden speaker was quite satisfactory. In case a horn is used



FRAME READY FOR FLOORING



PANELLING FOR FINISHED REAR

it will be placed as shown in the lower drawing. This requires a small horn. A supplementary panel, as shown in the full-page drawing, is placed just behind the front door. Thus, by opening this door, the horn is directed into the room, a necessary arrangement, as the horn has positive directional qualities.

Certain adaptations will be necessary for different sets. For example, with a large gooseneck horn, the end compartments could be made smaller to take the A-battery in one end and the charger in the other, with the horn exposed on top of the cabinet. If a loop is used, it may be mounted on the inside of one of the end doors. If desired, a wooden horn may be built to conform to an end cabinet, and the unit attached. In fact, this design may be regarded as basic, and any necessary change is easily made by merely altering the dimensions of the component parts.

It will be noticed that when the cabinet is completed there are no projections. The corners from floor to top are unbroken lines. The paneling is inset to make this possible. The result is that the work is made far easier than it would be if more complicated cabinetmaking methods were employed, yet the result has a certain severity of outline that is very attractive.

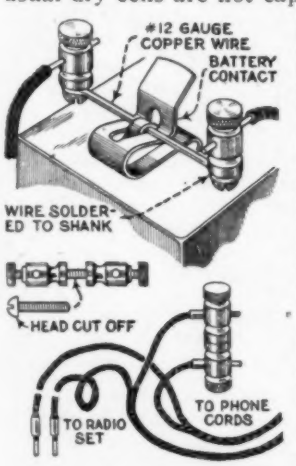
The finish may be of any kind, but if no other finish is especially desired, the fret-sawed two-tone effect cannot be surpassed for simple yet elegant appearance.

Dust between Condenser Plates Causes Volume and Selectivity Loss

In many cases of trouble with radio-receiving sets the cause is some trivial thing that escapes the eye. Dust between condenser plates is one of these; sets will become noisy, lose volume and selectivity under such conditions, because dust particles form sharp points on the surface of the conductors permitting the energy to leak across to the other plate. Dust-proof condensers are now available, some completely shielded in a metal case, others provided with a dust-proof transparent shield of celluloid. If the condensers are not covered in such a manner, it is necessary to clean the plates with a pipe cleaner or similar brush. Make it a rule to do this at intervals, even if the plates look clean.

Using Old Binding Posts

As every fan knows, the batteries required for the newer-type radio sets offer a difficulty in making the connections to the contacts rigid. The terminals on the usual dry cells are not capable of holding more than one lead with good contact. This is especially true if the proper-size battery leads of No. 14 insulated wire are used. The upper illustration shows a simple way of getting around this difficulty. Take a short length of No. 14 busbar wire and bend the ends to hold a standard binding post securely. Solder this shank of the post to the end of the wire to make an absolute contact. Compress the battery terminal so that the special connection can be slipped under the projecting hook part of the battery terminal. If this is provided with knurled nuts, the busbar wire carrying the binding posts should be longer, with a loop formed at the center to slip over the terminal post.



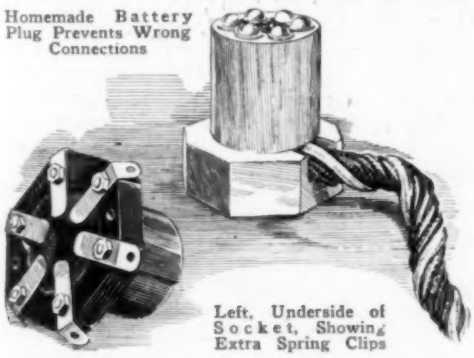
The two binding posts provide an easy method for making quick changes in the battery connections, and do not put an unnecessary strain on the terminals.

Another handy use for old binding posts is illustrated below; the head is cut from the machine screw furnished with the binding posts, and this screw is then used as a connection for the two posts, making an ideal connector for placing two or more sets of headphones in series.

Homemade Gang Plug and Socket Save Tubes

Radio experimenters who frequently test out new circuits or apparatus are worried by the risk of wrong battery connections, which may be overlooked in the usual impatience to test the new devices.

One experimenter has made his battery connections fool-proof by always using a tube socket for the battery terminals in the receiver, then connecting the leads from the batteries to a wooden plug made to fit the tube socket. The socket is of the common type with extra clips mounted on the base. The six spring clips take care of the A, B and C-battery connections. An ordinary four-prong socket can be used if the set requires only four battery connections such as A+, B—, B-22 and B-90. The plug is drilled to take the required number of machine screws, which act as contacts, and the various battery leads are then soldered to the ends of these screws. The wood base is hollowed slightly for the plug, and a small section is cut away for the leads which are twisted in cable form.



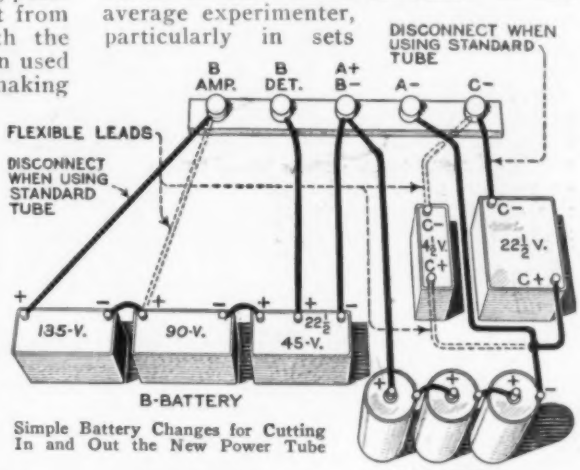
Homemade Battery Plug Prevents Wrong Connections

Left, Underside of Socket, Showing Extra Spring Clips

A pin in the side of the plug prevents wrong insertion of the plug in the socket, and the experimenter is always sure that all batteries are correctly connected.

Simple Battery Changes for New Power Tubes

The installation of the new power tubes seems to offer some difficulties to the average experimenter, particularly in sets ordinarily equipped with only one stage of a.f. amplification, and those which have two stages but will operate the loud speaker only on the last stage, and even then with too little volume to suit the operator on distant stations. On the other hand, the volume on the last stage may be too great for locals, and some simple means for cutting out the power tube when not required is desirable. All this can be handled nicely by the arrangement shown in the diagram.



Simple Battery Changes for Cutting In and Out the New Power Tube

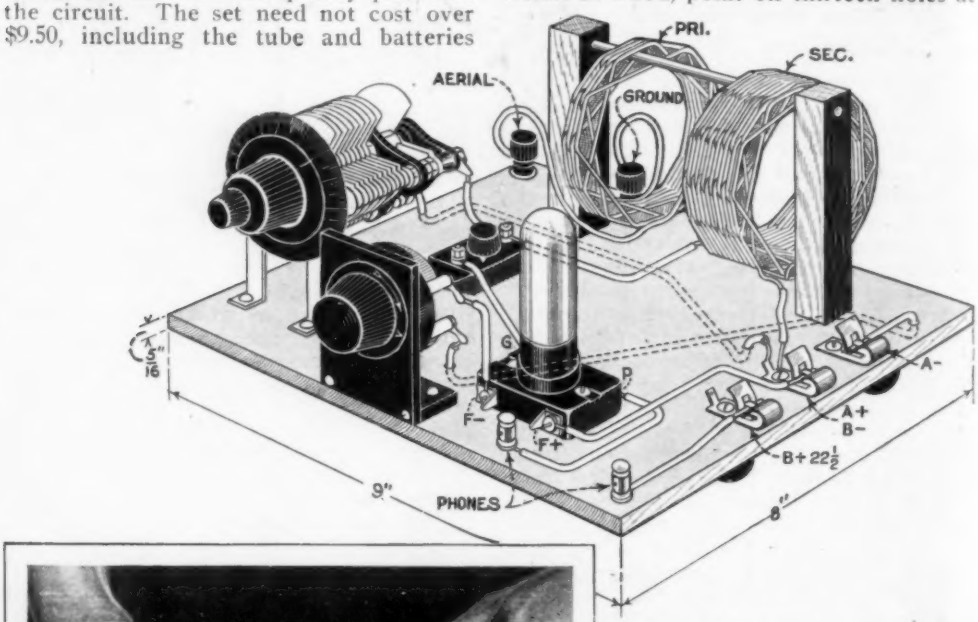
A socket of the new standard UX-type, which will take the 3-volt and 5-volt tubes as well as the common type, is provided. Inspection of the diagram will reveal a simple but effective method of changing the ordinary C-battery connections, as well as the necessary shift from 135 to 90 volts of B-battery suitable for cutting out the power tube and replacing it with the standard-capacity tube for local reception on the loud speaker. The diagram shows the 22½-volt C-battery used with the 3-volt power tube; if the 5-volt tubes are used with the 135-volt B-battery, it is necessary to have a 9-volt C-battery instead of the 22½-volt unit. The writer estimates that the change from power to standard-capacity tubes can be made with this arrangement in less than three minutes. The power tubes are fine for distant reception but for local work the standard tube will give better quality of tone. The diagram given is suitable for the small-tube super set now in general use, where one stage of audio amplification is used.—L. H. Georger, Buffalo, N. Y.

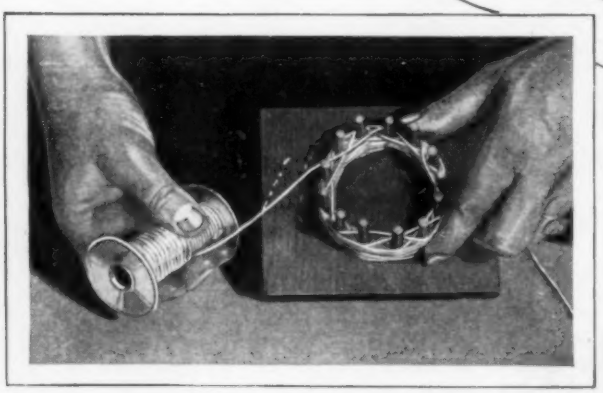
A Cheap and Efficient Dry-Cell Tube Set

By JOSEPH SHOGREN

THIS set is especially designed for the beginner who is ready for the step from the crystal receiver to the tube. The layout is arranged so that the experimenter can try out various types of detector circuits, and use parts from the old crystal set if desired. There are no panels to drill, and the set is extremely simple to build. The coils are homemade, and the coil mounting is so constructed that coils of various sizes can be quickly placed in the circuit. The set need not cost over $9.50, including the tube and batteries but not the phones. A good pair of 2,000-ohm phones can be obtained for $3.50, however. Receivers of this type are not toys, but really efficient instruments, bringing in stations 500 to 600 miles away during silent night in Chicago, with good clear reception. The set is fairly selective, as the coupling between the coils can be varied, if flexible leads are used, by sliding the coils along the rod. Selectivity can be further obtained by using a larger primary coil, tapping off the coil to an inductance switch; a .0005-mfd. variable condenser in series with the aerial lead will also provide closer tuning, if the set is used near powerful stations.

To make the form for winding the coils, inscribe a circle, 2½ in. in diameter, on a block of wood, point off thirteen holes at equal distances around this circle, and with a hand drill sink holes for thirteen wooden pegs or nails, 2½ in. long. If nails are used, cut off the heads so that the coils can be withdrawn from the form. Wind the coils with No. 22 d.c.c. magnet wire, leaving a starting end 4 or 5 in. long, and winding in and out over two pegs and under two pegs; mark one of the pegs and count each turn as this peg is passed. Fifty to sixty turns are wound on the secondary coil, and from 16 to 40 on the primary. Make up several primary coils for experimenting. When the coil is wound, remove it carefully from the form, and, with light string or heavy thread, sew in and out through the holes left by the pegs, tying the ends of the thread so that the coil will retain its compact shape.





Above, Diagram of Connections of the One-Tube Receiver; Below, Method of Winding the Coils

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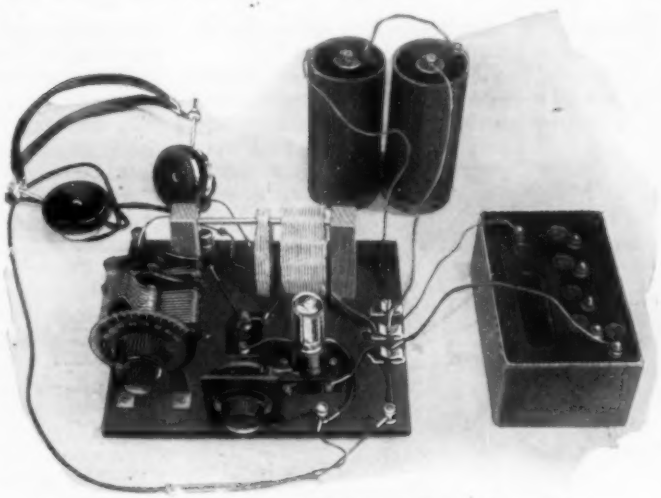
The detail of the wood uprights for the coil support and rod are given in the diagram. The holes for the rod should be large enough so that it can be slipped out when the coils are changed. The wood baseboard is 5/16 by 8 by 9 in., and four rubber feet are used to elevate it above the table. The instruments should be arranged on the board as shown in the wiring diagram; the variable condenser is mounted on two brass brackets, which are drilled ½ in. from the top to take the condenser-mounting screws, and at the base for two wood screws. It should be of the type having extra vernier plates, if possible, although the non-vernier type can be used if the other is not available. The rheostat is of the 25 or 30-ohm type suitable for the UX-199 or CX-299 tube, and is mounted on a bakelite or wood mounting, as shown. This mounting bracket is 2 in. wide and 2½ in. high; the gridleak and grid condenser are mounted directly behind the rheostat, the type shown being a combined unit with a variable leak. A separate .00025-mfd. condenser and 2-meg. gridleak can be used, however. Note that one side of the grid condenser and gridleak goes to one side of the variable condenser and also to the secondary coil; the other side of the leak and grid condenser goes to the grid post on the tube socket. The tube socket is of the type suitable for the new 3-volt tubes, and will also take the new 5-volt UX-201A and CX-301A, if the builder wishes to use one of these. In this case, it will be necessary to employ an A-battery of four No. 6 dry cells connected in series, while the B-battery remains the same and no other change is necessary. The binding posts for the ground, aerial and phones are mounted on the base in the positions shown; the A and B-battery terminals, arranged at the edge of the baseboard, are Fahnestock clips and are fastened with short wood screws.



Complete Set, Showing Batteries and Phones Connected

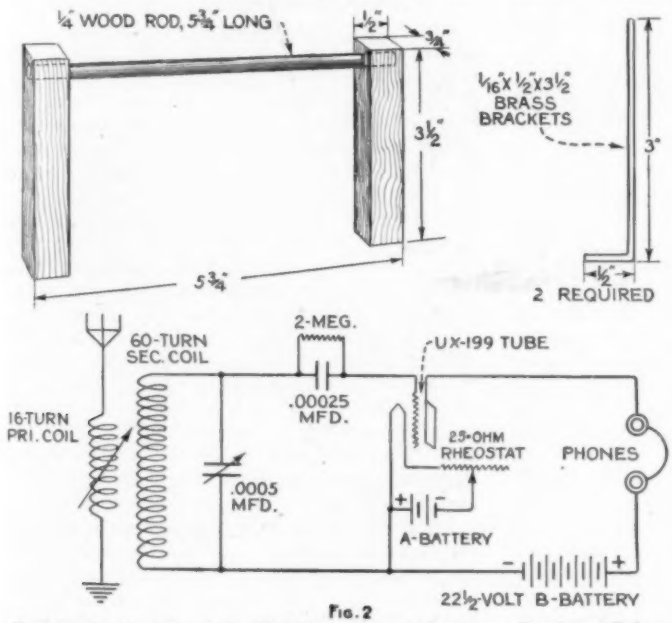


Fig. 2

Construction Details of the Coil Supports and Condenser Brackets; Below, Schematic Diagram of the Circuit

The set can be wired with the No. 22 d.c.c wire left over from the coils; black-spaghetti tubing can be used on this wire where necessary to prevent possible shorts. A schematic diagram of the wiring is given, but if the picture diagram is followed and each wire run exactly as shown, good results are sure to

follow. The dotted lines indicate the wires carried under the baseboard.

Connect the A and B-batteries before placing the tube in the socket; turning the rheostat to the off point switches the set off. The experimenter will find that this simple layout will lend itself nicely to such hookups as the reflex, three-circuit regenerative and ultra-audion. A one-wire outdoor aerial, 75 to 100 ft. long, will give the best results.

Blueprints of the wiring diagram, and battery connections for using either type of tube may be obtained from the Radio department, Popular Mechanics Magazine, 200 E. Ontario Street, Chicago. Inclose 15 cents to cover postage and packing. Specify blueprint No. 107.

MATERIAL LIST

1 wood baseboard, 5-16 by 8 by 9 in.
2 pieces wood, ½ by ¾ by 3½ in.
½ lb. d.c.c. magnet wire.
1 wood rod, ¼ by 5¾ in.
1 7-in. brass strip, 1-16 by ½ in.
1 vernier variable condenser, .0005 mfd., and dial.
1 rheostat, 25 or 30 ohms.
1 tube socket, new, for UX-199 or CX-299 tube.
4 binding posts.
3 Fahnestock clips.
1 grid condenser, .00025 mfd., and 2-meg leak (for combination).
1 UX-199 or CX-299 tube.
2 No. 6 dry cells.
1 22½-volt B-battery unit.
2 round-head brass machine screws, 6-32, ½ in. long.
4 round-head brass wood screws, ¾ in. long.
5 round-head brass wood screws, ⅜ in. long.
4 round-head brass wood screws, ½ in. long.
1 2-ft. length of black-spaghetti tubing.
4 rubber feet.
1 set headphones, 2,000 ohms.
1 ground clamp.

How to Overcome Body Capacity

Every radio fan has heard of body capacity until he is tired of it, and it is safe to say that nearly all of them have had their own troubles with it. Be that as it may, most of them would have better luck if they had a better understanding of what it really is. What is this mysterious force that often upsets the finest tuning with unruly squeals, and what is the best way to overcome its effects?

Body capacity, or hand capacity, is the term applied to the property of the human body which makes it behave as an electric condenser. The body is not a good condenser. Compared with the variable condensers in a receiving set it has an extremely small capacity. The trouble is that even an extremely small variation in either capacity or inductance of a set can throw fine tuning out of adjustment. Each time the operator's hand takes hold or lets go of a knob in the process of tuning, the capacity of the set varies slightly, because some of the body capacity is communicated to the set while the hand is in contact with it. Then you know too well what happens. A very fine adjustment of the total capacity of a set can be obtained with modern vernier knobs for rotating the parts of the condensers, which supply practically all of the capacity of the circuit. In the same way a very fine adjustment of the total inductance is obtained by rotating the parts of the coils which supply nearly all of the inductance in the circuit. Thus these two elements in the set itself can be very closely controlled. Body capacity, while small enough in itself, is quite beyond control. That is why, if it is allowed to act on the set at all, it is likely to upset the whole scheme.

Some radio enthusiasts who can build anything from a pocket crystal set to a superheterodyne do not know just why this adjustment of capacity and inductance values is so important in its effect on reception. The reason, technically, is that when these values are properly related to each other for any given wavelength, the total equivalent resistance of the circuit is reduced to the minimum. As the voltage supplied to the set by batteries or lighting circuit is constant, minimum resistance means maximum current. With the maximum current flowing through the set, the point of resonance is reached—the point at which signals are strongest.

Attempts have been made to eliminate body capacity by various methods, but the most effective has been the protection of the panel, or, in some cases, of individual parts of the set, with a metallic shield. The shield, until recently, had to be applied either by the user or by the dealer, but an anti-capacity panel of hard rubber is now being made with a shield vulcanized in place, and this is very effective. Shielding, while decreasing the effects of body capacity, does not detract in any way from the quality or volume of the tone.

In order to make shielding thoroughly effective, care must be used in making connections in the circuit. The grid and plate terminals are most sensitive to body-capacity effects. Keep the parts of the coil or apparatus to which the grid or plate is

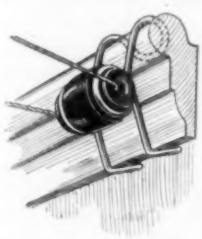
connected as far as possible from the panel. The filament circuit must be properly grounded. When variable condensers are mounted on the panel, connect the rotor plates to the ground or filament side. There are variable condensers on the market with end rotor plates, which can therefore be termed self-shielding. With a series condenser in the antenna, the rotor plates should be connected to the antenna; with the condenser in the ground circuit, the rotor plates should be connected to the grounded side. A condenser across the secondary should have the stationary plates connected to the grid.

With a variometer in the secondary circuit, the stator end is connected to the grid; in the plate circuit, the stator end is connected to the plate. Where a tickler is at the end of an inductance, which is the case with many variocouplers, the end of the coil farthest from the tickler end should be connected to the grid.

In locating the sockets, keep the grid and plate terminals farthest from the panel, and place the filament leads toward it. It is helpful also to shunt the phones with a fixed condenser of .001 or .002 mfd. capacity, or if amplification is used, to connect a fixed condenser across the plate terminal of the detector tube and the negative side of the B-battery.

Picture-Molding Clamp for Indoor Aerial

An insulated support for indoor aerials that clamps on the picture molding has made its appearance on the market. It consists of a tubular porcelain insulator mounted on a wire clamp. This can be firmly attached to any standard picture molding, without the use of nails or screws. The-around-the-room aerial has almost the capacity of the outside aerial for volume, and the selectivity will not be impaired by its use.

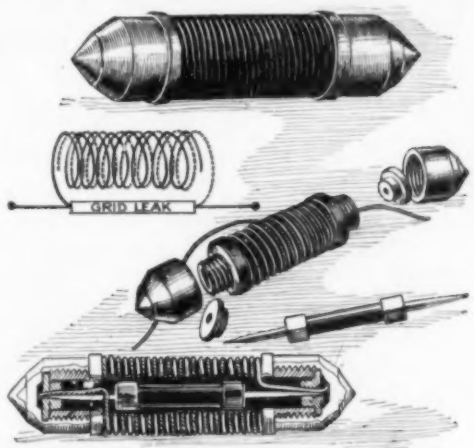


International Radio Week Tests

Popular Mechanics Magazine is interested in hearing from readers that have built sets described in the Magazine who were successful in bringing in distant stations during the International Radio week tests, Jan. 24-30, this year. Please state the type of set used and send a copy of your log.

Combined Gridleak and Condenser

Grid condensers are usually furnished with clips for holding the gridleak. A compact unit, which combines both the condenser and leak, is now on the market, however. It consists of a pair of wires, coated with a special insulating material and wound in parallel, in a single layer, upon a bakelite bobbin. One wire is connected to one cap and the other wire to the opposite cap, as indicated in the drawing. Each wire has one open end and one end connected to a terminal, thus forming two plates of a condenser. The method of winding is claimed to insure that the spacing between them can vary only a trifle, which gives extreme uniformity. The gridleak is suspended in the center of the bakelite bobbin on which the wires are wound, and the ends of the leak are connected to the caps as the wires. This completes the arrangement and the caps are then screwed down tightly.



Combined Grid Condenser and Leak Assembled, and Disassembled to Show Parts and Method of Winding

Dry Cells Are Rechargeable

In a new rechargeable dry cell the container is a cylindrical zinc plate which serves as the negative electrode, and the positive plate an especially designed grid said to prevent the active materials from falling out. The moisture needed by the battery from time to time is supplied by adding two or three eyedroppers full of distilled water every two or three months. The cells may be used singly, but generally are put up in six-cell units in cabinets, with built-in rechargers; the whole outfit is then connected with the radio set and the 110-volt house-lighting supply.

"Canned" Radio Set Eliminates Body Capacity

Radio sets having shielded units are known as "canned" sets. Several types are now on the market, and are attracting much favorable comment. The set shown is

"Canned" Radio Set, Showing the Various Units Inclosed in Metal Containers

one of the tuned r.f. type and is inclosed in nickeled brass; each tube is shielded in metal stalls, eliminating body capacity and adding much to the efficiency of the set. The fields of the various coils also are confined, limiting the troublesome stray pick-up which is so common with the unshielded types.

Simple Connections for A-Battery Charger and B-Eliminator

The problem immediately confronting the radio builder, or the purchaser of a new set, is proper connections for the A-battery charger and the B-eliminator. A number of switches are not desirable, the fewer operations necessary the better. The diagram herewith works out nicely, and the method is so simple that anyone can use it. A three-pole double-throw switch, a wall socket of the pull-apart-type and the necessary lengths of lamp cord are required. If there is no wall socket near the set, an extension cord can be used. If the set is of the cabinet-type the pull-apart socket may be mounted at any convenient point near the set; if a console is used, the lamp cord is brought in through the rear of the battery compartment and the socket mounted on the inside. Mount the switch at a convenient point, and run the wires as shown in the diagram. Two leads are taken from the one side of the wall socket so that the 110-volt a.c. supply is available for both the charger and B-eliminator; note that the other side of the supply line goes direct to the switch-lever post. The other two lever-posts are connected to the positive and negative terminals of the 6-volt A-battery; mark these terminals on the switch so that the corresponding leads to the set and the charger will be of the right polarity.

When placing the A-battery on charge, plug the charger into the wall socket, and throw the switch over, connecting the charger to the battery and at the same time automatically cutting in the a.c. supply. When taking the battery off charge, pull up the switch to the off point, and remove the charger plug; the B-eliminator plug is then pushed into the wall socket instead. When ready to operate the set the switch is thrown to the set connections, and the B-eliminator is automatically placed in operation. There should be no filament switch on the panel of the set as this three-pole switch turns on the A-battery supply to the tubes and puts the set in operation. If there is a switch on the panel, it should be left turned on at all times, and the three-pole switch used instead. This is important, as the B-eliminator must be turned off when the set is not in use, and if there is more than one switch, there is the chance that the operator will forget to turn one of them off. Pulling the three-pole switch to the upright position turns off all electrical connections.

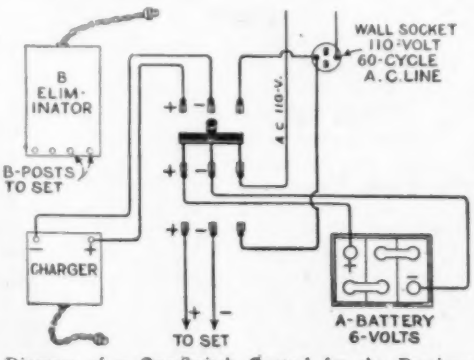
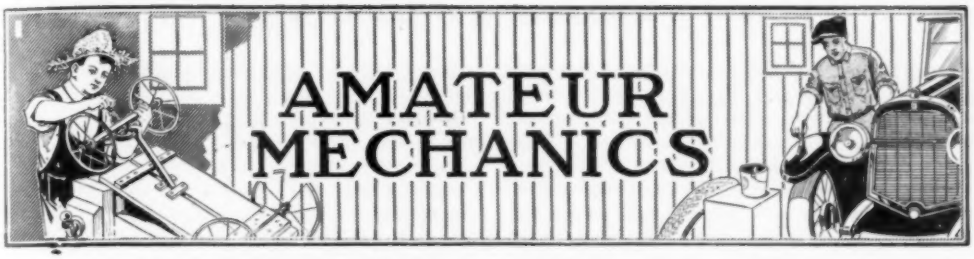


Diagram of a One-Switch Control for the Receiver, Battery Charger and B-Eliminator

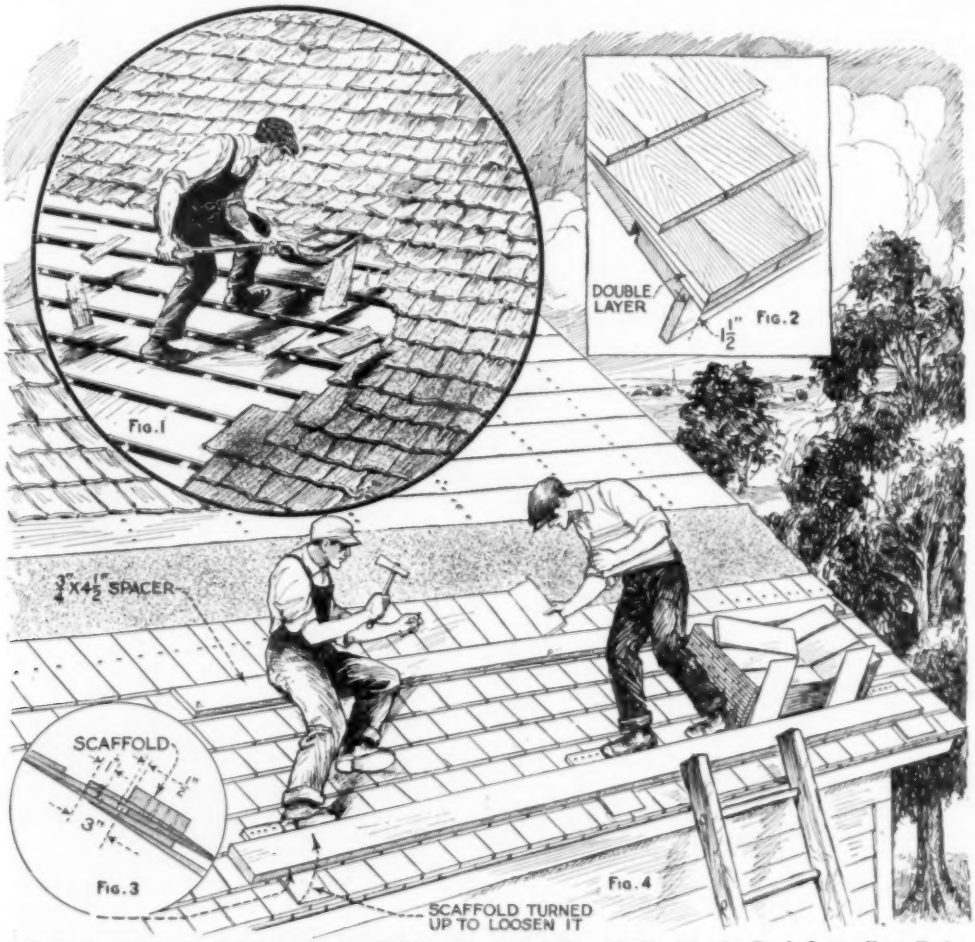
For DX reception more volume can be obtained if the full rated plate voltage from the B-battery is used on the amplifying tubes.



Reshingling Your Roof

By E. R. HAAN

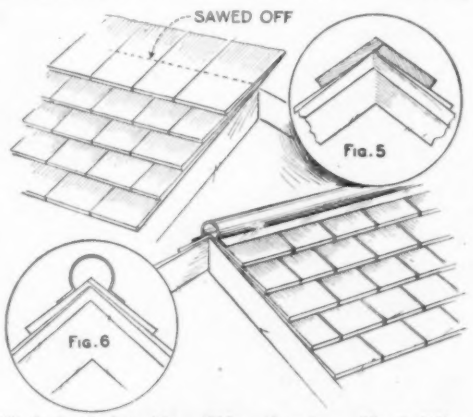
IT seems an easy task to reshingle a roof, and it really is easy if one knows how. By proceeding along the lines given in this article, almost anyone can do as good a job as an expert. The first step is to measure the roof area and then purchase enough shingles and building paper to cover it. The best quality of cedar shingles should always be used. They come in bundles, each containing enough to cover an area of 100 sq. ft. The cost of shingles is from $3.50 to $4.50 per bundle. Building paper comes in rolls, 36 in. wide, each of which will cover 100 sq. ft. The price per roll is about $1.50. Set your ladder against the edge of the roof and re-



Removing Old Leaky Shingles; Laying Building Paper, and Then Reshingling the Roof, Is an Easy Task That Anyone Can Accomplish

move the old shingles with the aid of a shovel, as shown in Fig. 1. Don't rip off the shingles from the entire roof, or you might have the sad experience of seeing an unexpected shower drench the roof and the plaster ceiling in the rooms below, which would mean considerable expense.

Start ripping off the old shingles along the bottom and work upward. Ordinarily it is advisable to remove enough shingles to leave a strip, about 6 ft. wide and extending the length of the roof. Drive all the old rusty nails down and tack a strip of building paper to the roofing boards. Then lay a double thickness of the shingles along the lower edge of the roof, allowing them to project about 1½ in. over the edge, as shown in Fig. 2. You will notice in the drawing that the joints are broken, as in a brick wall, so each shingle covers about half of two shingles underneath, to prevent leakage. A length of ¾-in. board, exactly 4½ in. wide, which is to be used as a spacer, is tacked over the first row of shingles, even with the lower edge, and a new single row of shingles laid over the first double row, observing the precaution of laying them halfway over the ones underneath.



Method of Attaching Ridge Board or Metal Ridge Roll to the Roof after Shingling

Shingle nails are used, and a shingling hatchet will be found convenient and less tiresome to work with than a hammer. Two or three nails are driven into each shingle in line, about halfway between the thick and thin ends. Each time a row is laid and nailed, the spacer is moved up, and the same operation is repeated. As soon as the shingles nearly cover the first strip of paper, remove some more old shingles, drive the old nails down, apply another strip of paper, and proceed as before. After three rows of shingles have been laid, a scaffold is made as follows: Take a suitable length of 2 by 4-in. wood and nail three wide shingles to it, as shown in Figs. 3 and 4. Notice exactly how these are nailed to the scaffold so that they project about 3½ in. from the edge. A second shingle is nailed to the first, with the thick end 4 in. from the thick end of the first. Then the scaffold is nailed to the roof. Four or five shingle nails, all in a row, are driven through the thick end of the upper shingles on the scaffold and into the shingles on the roof. By leaving ½-in. clearance between the edge of the scaffold and the edge of the row of shingles just above it, a couple of shingles can be set up to hold the whole bundle, as indicated. A scaffold of this kind will support considerable weight, and when it is to be loosened and moved, it is merely turned over as indicated by the arrow. When the ridge of the roof is reached, saw off the shingles at the edge and after the other side of the roof has been reshingled, apply a ridge strip, which may be of wood or metal, as shown in Figs. 5 and 6, respectively. The latter can be obtained from any lumber-supply concern. Most old houses have the roof boards spaced 1 or 1½ in. apart, as shown in Fig. 1, which was done mostly for the sake of economy, but newer houses have the roof boards laid close together.

If desired, asphalt shingles can be laid instead of wooden ones. On new houses this can be done without making any changes, proceeding in the same way as with wooden shingles. However, a scaffold of the type described cannot very well be used when applying asphalt shingles as leaks through the nail holes would result, whereas the shingle nails will not go through the wooden shingles entirely, if nailed near the thick end. On old houses having spaces between the roof boards, it is advisable to fill these with strips before applying asphalt shingles. Continuous hip shingles of metal can be used on buildings that have hip roofs.

Fumigating the Incubator

For best results, an incubator should not only be cleaned thoroughly before it is used, but it should also be fumigated. Get a formaldehyde candle from a drug store. Set it in the incubator. Light it and close the door almost tight. The fumes will kill all the germs that may be lodging there and this will better your chances of getting a good hatch. Air the incubator two days before setting eggs.

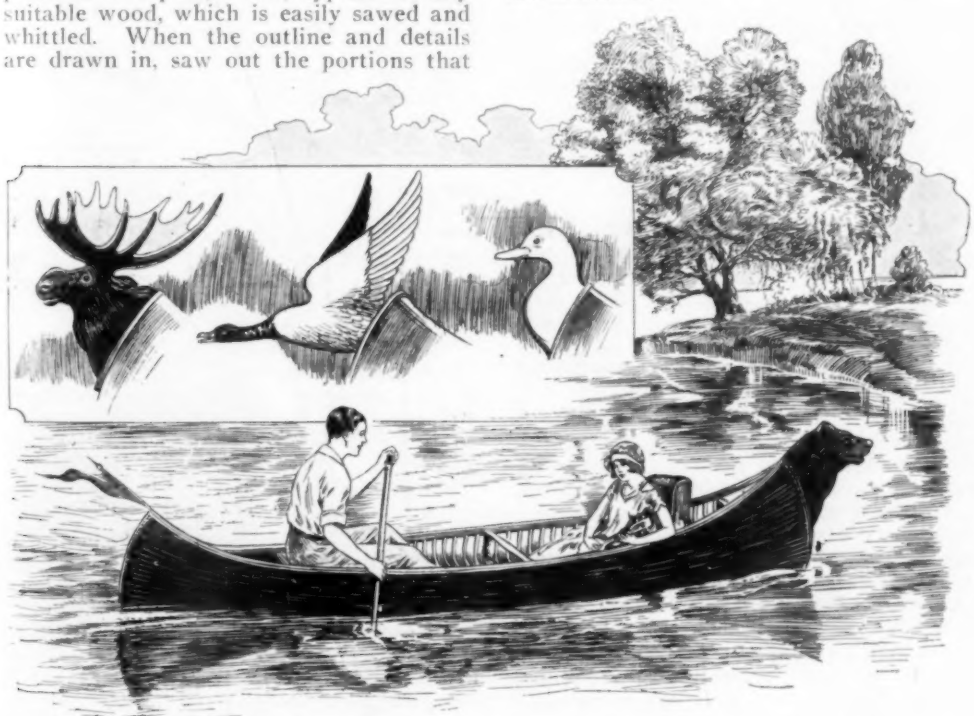
Ornamental Figureheads for the Canoe

If you want to be the first in your neighborhood to have something really attractive and novel in the boat line, make some figureheads for the canoe. Figureheads, you may know, were always attached to the prows of old ships as a sort of an emblem of good luck. They were carved in beautiful, grained woods, and some that have been preserved in the marine museums are works of art. So, just as a good-luck charm, let's see what can be done to decorate the bow of the canoe.

The illustration suggests four different models that can be used and, of course, your personal likes will suggest many more that can be as easily made. If you have no artistic ability, let an artist friend trace out the shape and suggest the coloring. The figure chosen for your decorative scheme must be one that will lend itself to being shaped to fit the curved end of the canoe. Thus the goose, the moose and the bear fit the purpose admirably.

The selected one can be marked out in pencil on the surface of a smooth piece of soft pine, cedar, cypress or any suitable wood, which is easily sawed and whittled. When the outline and details are drawn in, saw out the portions that can be reached with a keyhole saw. Then cut out all smaller details of the edges with a sharp jackknife until the final outline is finished. After that, go over the edges and both sides with fine sandpaper. Draw in the details again with a soft pencil and give the board a coating of shellac. Prime the board with flat white paint, and when dry, the details can be painted in. As the outlines of the details will show faintly through the priming coat, no redrawing will be found necessary. Use artists' colors if possible and work from a colored print to get the coloring correct. When completed on both sides, set it aside to dry for several days. After the paint has hardened, the surface should be given an application of good spar or automobile varnish. Do not use floor varnish, as this will become white when wet.

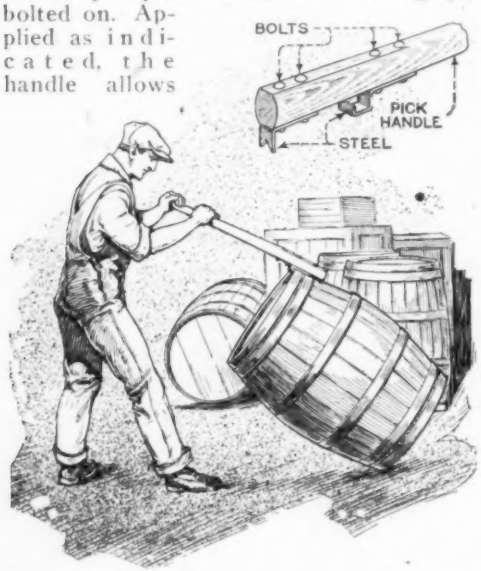
Screw a thin strip of oak to the curved part of the back of the figure and let it project 2 or 3 in. at each end. Then, after removing the brass molding from part of the bow, screw the strip in its place. This will support the figurehead in front of and at the top of the bow as illustrated.—L. B. Robbins, Harwich, Massachusetts.



Ornamental Figureheads of a Goose, a Moose, or Any Other Suitable Design, Are Distinctive and Novel, and They Can Readily Be Made by Anyone Having Some Artistic Ability

One-Man Barrel Lifter

One man can easily stand or tip a barrel weighing from 400 to 500 lb. by using the simple lever shown in the drawing. It is merely a pick handle, with steel grips bolted on. Applied as indicated, the handle allows



Handling Heavy Barrels Is Facilitated by Using This Simple Lifter

considerable leverage and makes it comparatively easy to manipulate heavy barrels.—Clinton Hinman, Naugatuck, Conn.

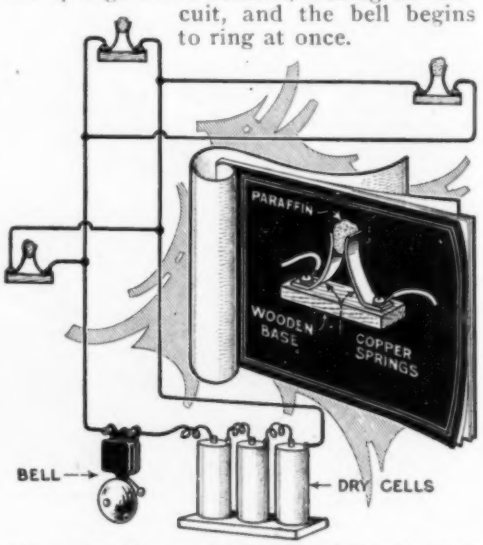
Running In New Motors

New motors, with all bearings and parts fitted tight, are not immune from trouble, as is generally supposed, but must be handled and treated with care. The writer has endeavored to incorporate into a few brief rules, the precautions necessary to observe during the first 1,000 miles of use of the motor.

Add 1 qt. of oil to every 10 gal. of gasoline, continuing this for the first 500 miles of operation. Never exceed a speed of 25 miles per hour or drive in high gear at a speed less than 5 miles per hour. Never open the throttle wide, permitting the engine to race, when the car is standing still, or while shifting the gears. Avoid having the engine running with the spark retarded for any length of time or to idle in this condition. The overheating resulting from this practice, causes bearing wear, stuck valves and rapid carbonization. Rich mixtures are invariably used with new motors, which, combined with the fact that piston rings are seldom lapped into the cylinders, permits considerable seepage and dilution of crankcase oil. The diluted oil fails to lubricate properly with consequent bearing damage. The oil should be changed after the first 150 miles, again after the next 500 miles and also every 500 miles thereafter. The unlapped pistons and cylinder walls are responsible for much metallic dust which contaminates the crankcase oil. By changing the oil at the stated intervals, the clogging of oil distribution pipes and the gritting of gears and bearings will be prevented. Due to the excessive heat in a new motor, attention should be given to the cooling system. The radiator should be refilled daily and should be drained periodically. Outside of the engine there are many new and stiff controls which become dry and will wear quickly if worked in this condition. Keep a filled oilcan handy, giving a few drops occasionally to each control and moving part, which will permit it to work itself into a good bearing seat.—G. A. Luers, Washington, D. C.

Easily Made Fire-Alarm System

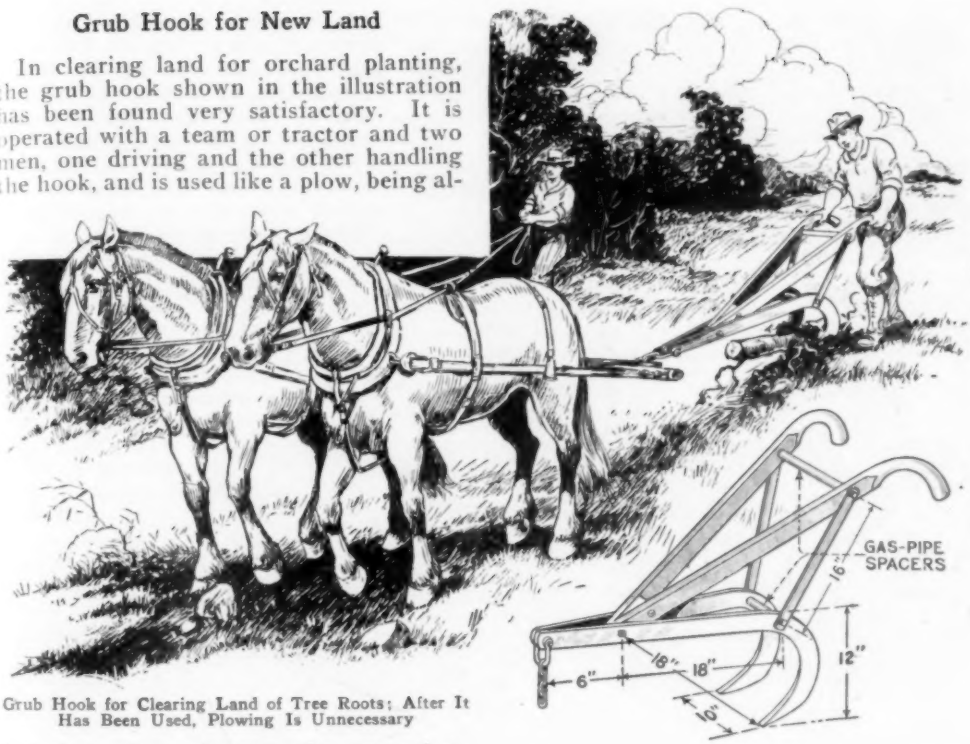
The accompanying diagram shows a simple and useful fire alarm. Two copper or brass springs of the flat type, are mounted on a wooden or other insulating base, and a small block of paraffin is placed between the springs. The springs are placed in different parts of the building and are all connected to a common bell. If a fire occurs, the paraffin quickly melts, the springs make contact, closing the circuit, and the bell begins to ring at once.



Novel Fire Switches Which Close Automatically on Being Subjected to High Temperature

Grub Hook for New Land

In clearing land for orchard planting, the grub hook shown in the illustration has been found very satisfactory. It is operated with a team or tractor and two men, one driving and the other handling the hook, and is used like a plow, being allowed to drag through the ground to catch the roots. A deft turn of the handles frees it from the roots just pulled, without the necessity of stopping. After this tool has been used, the ground will be so well dug up that plowing is unnecessary. The dimensions given in the drawing have been found to be about right. The points should not be spaced farther apart than 10 in.—J. H. Deniston, Bayfield, Wis.



Grub Hook for Clearing Land of Tree Roots; After It Has Been Used, Plowing Is Unnecessary

Soft-Focus Attachment for Enlarging

A soft-focus attachment for the enlarging camera, which gives excellent results for pictorial and portrait work, when the harsh, needle-sharp definition is not wanted, can easily be made from a tin lid of sufficient size to fit snugly over the lens, and a small sheet of brass cloth. The top of the lid is cut out and the brass cloth soldered to it. This makes a diffuser which can be attached or detached at will. Various sizes of mesh can be soldered to as many different lids, and the set will provide diffusers suitable for any work. Very good results can be obtained by exposing the paper only half the necessary time, and then completing the exposure with the diffuser attached. This gives a sufficiently sharp image which at the same time possesses softness. Good, rich blacks are obtained by giving short but sufficient exposure, whereupon the developing is done in restrained developer.—L. C. Ferguson, Ontario, Calif.

Removing Glass Bottle Stoppers

Many devices have been suggested for removing stuck ground-in stoppers from bottles, but for ease in manipulation the wooden handle shown in the drawing is hard to beat. It consists of a strip of wood in which a slot has been cut to fit over the glass handle on the stopper. To loosen a stopper, place the wooden handle over it and try to twist it backward and forward gently. After a few attempts, the stopper will be loosened. Only a gentle effort is required, and if done with care, the glass handle will not be broken.—C. A. Oldroyd, Barrow-in-Furness, Eng.

Chair Sled Accommodating Two Is Latest Departure from Conventional Sled Design

Novel Sled Built like Chair

The novel chair sled shown in the photo is quite a departure from the conventional design and in many ways preferable to the latter. One sits on the seat while footrests on the runners permit another to stand up behind. The weight is well distributed and a handle is provided so that the child standing can hold on securely and also steer the sled. The average boy can easily make one of these from scrap lumber usually found around the house. Strap iron can be used for runners.—W. H. Soames, Minneapolis, Minn.

Effective Method of Trapping Rats

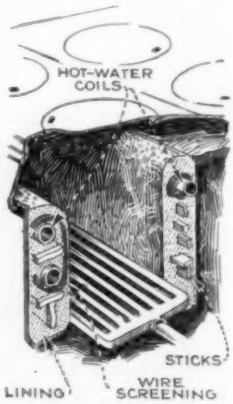
A neighbor of a friend of mine has an effective method of catching rats which might well be tried by anyone who is troubled with these pests. He takes advantage of the fact that rats will go to great pains to get water during a dry season. For a few nights tubs or deep buckets are placed in a barn or basement or in the alley. These are filled with oats or crumbs of bread and enough water is poured in them to come about halfway up the sides. The rats soon learn to dig into the bait for the water. After they have been running to the water a few nights the bait is emptied from the tubs and replaced with water, the tubs being half filled. The surface of the water is covered with screenings of corn or other grain. During the night the rats come as usual, but when leaping over the edge of the vessel they find themselves trapped in the water and soon are drowned. He caught as many as 14 rats in three tubs one night, of which seven were in one tub.—August Jeffers, Bedford, Ind.

Packing Groceries

The proprietor of a self-service grocery store has solved the problem of packing and displaying staple articles, such as dried beans, fruits and similar bulk commodities, in the following way: A screw-top bottle is filled with the article contained in the shelf divisions, and on this bottle a label is pasted, giving the name and price of the goods. During spare time, the clerks weigh out and wrap packages, and the shelves are kept filled, so that the customer need not weigh his own bulk goods or have someone else do it. By making the packages of uniform size, the difficulty of dealing with fractional units is eliminated.

Reinforcing Stove Lining

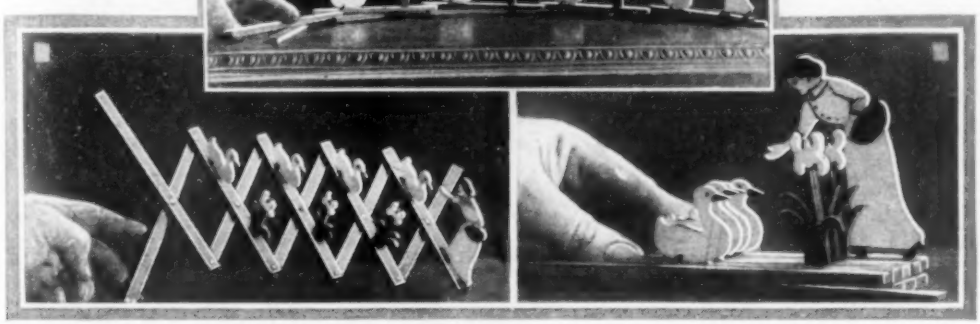
After relining my kitchen stove several times, I found that the lining first gave way under and between the pipes, where the layer of cement was thin. To lengthen the life of the lining, a piece of ¼-in. mesh screen was bent around the pipes but not against them, as shown in the drawing. Through this screen the cement was worked with a trowel. A few slender wooden sticks were also imbedded in the lining, which tended to reduce, if not entirely eliminate, warping and shelling. Of course, no portion of these sticks was left uncovered by cement as they would then burn. This method of reinforcement was found entirely satisfactory.—R. C. Tarr, Gloucester, Mass.



Two Simple and Interesting Toys

By W. P. MOTT and L. R. BUTCHER

THE extension "duck pond" toy shown in the first illustration is an easily made article, which, when not in use, folds compactly. The supports for the ducks, lilies and figure are strips of soft wood, ¼ in. thick, ⅜ in. wide and 6 in. long; eight of these are required, and two more of the same stock, 8 in. long, for the handles. The strips are stained a gray-green color. The ducks are made of any available thin wood or veneer, sawed to shape with a coping saw or fretsaw, and painted white with yellow bills. A little stud should be left extending from the base of each duck, about ¼ in. long; this is inserted into a hole drilled in the strip when assembling. The lilies are made of the same material as the ducks and colored with green stems and leaves and purple blossoms; the figure also is of the same material, and has a blue gown, brown hair and basket. The method of fastening the figure and the lilies to the strips is the same as followed for the ducks.



A Simple "Duck Pond" Toy That Any Boy Can Make; Variations of the Design Will Produce Other Interesting Toys

Take four of the 6-in. strips and one of the 8-in., lay them edge to edge, close together, and aline them at one end. Draw a pencil line across all the strips, measuring 3/16 in. from the end of the 6-in. strips. Draw a similar pencil line across the other end. Do the same with the remaining four 6-in. strips and the other 8-in. one. Draw center lines down each of the strips, then assemble them, as shown in the plan photo, and nail. The nails used are small brads, and they are driven through the strips, ⅛ in. in front of the center line of the strips, so that the toy, when extended, will assume a circular form, instead of shooting out straight. The brads are clinched on the bottom. If small washers can be obtained and used under the heads and ends of the brads the action of the toy will be more smooth, but the brads alone will serve very well if washers are unobtainable.

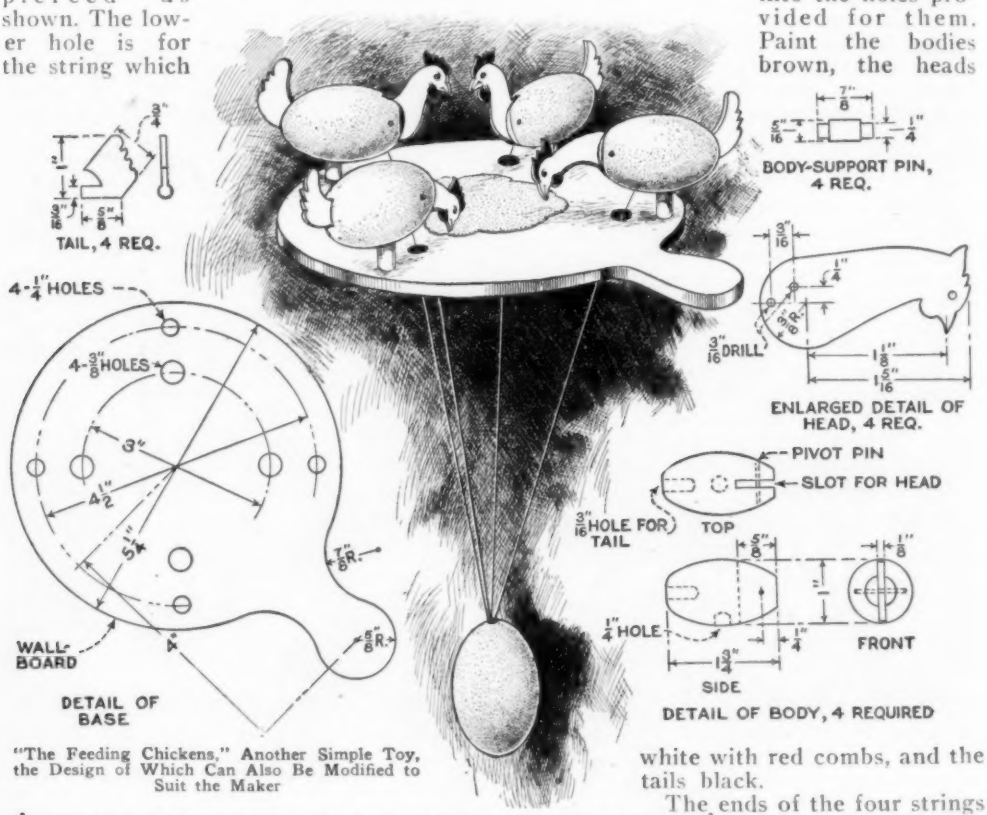
The interesting toy group shown in the second illustration is made to resemble four chickens, which go through the motions of feeding. The swinging of a pendulum suspended below the group causes the "head" of each of the figures to rise and descend alternately. A slight touch of the weight causes the movement to start.

The base is made of ordinary wallboard. The ¼-in. holes are made to receive the dowels which support the figures; the larger holes accommodate the strings from which the weight is suspended. The circular shape is but a suggestion; the holes, however, should be located as shown, from the center, if the sizes given for the other parts of the toy are followed.

The body of each chicken is made by turning a piece of wood to the egg-shaped form shown. Four of these are required; if a wood lathe is not available, ordinary round dowel stock of approximately the correct size may be used. Even thread spools will serve. The hole at one end is drilled 3/16-in. to hold the tail. The ¼-in. hole is for the supporting dowel. The slot at the end allows the head to swing freely on a pivot pin, the location of which is shown in the drawing.

Ordinary dowel stock is used for the supporting pins shown. These are glued to the bodies and the toy assembled by pointing the heads of the chickens toward the center of the base. Glue is also used to fasten the pins firmly in the base.

The head and tail need slight explanation. Stout cardboard or light sheet metal is used for stock in making four each of these. The head pieces are pierced as shown. The lower hole is for the string which is attached to the weight; the hole slightly higher up is for the pivot pin, while the top hole is the eye of the chicken. A piece of string, 9 in. long, is fastened to each of the head pieces and passed through the 3/8-in. hole in the base. Each of the head pieces is then pivoted to a body by means of a small brad driven through the body and passing through the pivot hole in the piece. The tail pieces are pressed into the holes provided for them. Paint the bodies brown, the heads white with red combs, and the tails black.



"The Feeding Chickens," Another Simple Toy, the Design of Which Can Also Be Modified to Suit the Maker

The ends of the four strings are attached to a weight below the base. Care should be taken to have the strings as nearly even in length as possible. As the pendulum swings, the heads of the chickens move up and down in a lifelike manner as long as the weight is in motion.

How to Make a Fluorescent Screen

Many experimenters have occasion to use a fluorescent screen, particularly those interested in X-ray work. Such a device is quite expensive if purchased, and may be made as follows:

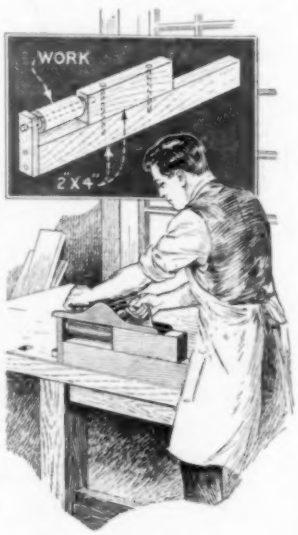
Mix 1 oz. each of common salt, sodium tungstate, and calcium chloride. Place the mixture in a crucible and heat it dull red in a coal fire, for several hours. It will melt into a clear liquid, and should then be removed and permitted to cool. The liquid will crystallize into a hard glasslike mass. Break this out of the crucible and crush it into small pieces. Put them into a jar of clear water. The sodium chloride resulting from the chemical change by heating, will gradually dissolve and the calcium tungstate will fall to the bottom in fine crystals. Wash this precipitate until all trace of the salt disappears; then pour the crystals upon a sheet of filter or blotting paper to dry. After drying, place them in a mortar and grind them to a fine powder, when they will be ready for use. To make the screen proper, procure a piece of thin white cardboard of the size desired. The calendered board known as three-ply is satisfactory. Paint the cardboard on one side with a thick solution of gum arabic

in water, or better still, with celluloid dissolved in amyl acetate. Permit the gum to become "tacky" before dusting with the chemical. The latter process requires care, to produce an even layer on the cardboard, and it is advisable to practice with ordinary salt before attempting it on the cardboard for the screen. The calcium tungstate should be placed in a dry jar and a piece of fine muslin fixed over the mouth of it. The chemical may be dusted over the surface with this sieve.

Shake off the superfluous crystal and permit the screen to dry thoroughly. Fasten a piece of mica, or sheet celluloid, over the sensitized surface to prevent damage to it. Mount the sensitized cardboard in a wooden frame of suitable size and arrange a hood around its edges to cut out unnecessary light. The sensitive side of the screen is, of course, held toward the observer.

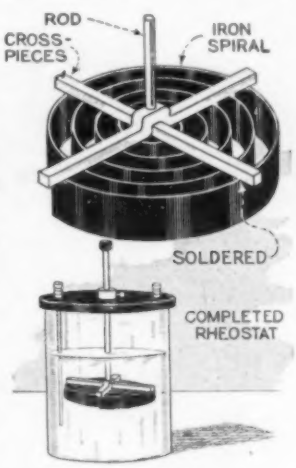
Wooden Roller Made without Lathe

If a lathe is not available, a small hardwood roller to mount on a short journal can be made as follows: The piece of wood is drilled through lengthwise for a driving fit and the journal driven in. Then the block is roughly shaped up to approximate size by splitting off corners. Spools are slipped over the ends of the journal, and the whole is mounted in an improvised fixture made of 2 by 4-in. hardwood. The holes for the journal are drilled for a tight fit and centered below the top of the block and board just the radius of the finished roller. Then a carpenters' jointer is used to plane down the roughly formed roller, care being taken to start the stroke at the end of the roller and stop it before the bit of the plane hits the end block. The roller is turned, until it is planed all around, then finished with a fine file.



Improved Electrode for Water Rheostat

Water rheostats are usually made of a large glass or porcelain jar containing horizontal electrodes. An improved vertical electrode which has a greater surface than that of the horizontal type, is shown in the drawing. This form allows the gases to escape more easily. The electrode is made of a strip of galvanized iron, 1 in. wide, bent to form a spiral with a ½-in. space between turns. Two strips of iron are crossed on the spiral and soldered to it where they touch. The vertical rod is fastened to the crosspieces, which may be done by drilling the latter and threading the rod. Two of these electrodes may be provided or one of them may be simply a rod. Of course, greater current will be passed if both electrodes are of the spiral type.—H. Busholwitz, Philadelphia, Pa.

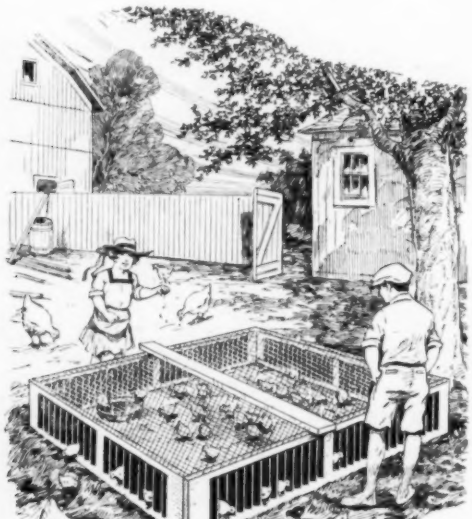


Economy in Motorcycle Tires

Caution in the use of motorcycle tires with a minimum of abuse will result in a considerable tire saving. Tremendous wear on a single spot results when the power is thrown in so suddenly that the driving wheel makes several revolutions before gripping the ground. The proper air pressure must be maintained in the tires in order to obtain good wear. Guessing is a poor method of determining the air pressure, and the exact condition should be noted from time to time with a gauge. Ordinarily, a pressure of 45 to 50 lb. should be maintained in the rear tire and about 20 per cent less in the front tire, in the case of 3-in. tires. Rim-cutting from running motorcycle tires underinflated is the commonest abuse. Dents in the edge of the rims cause undue wear on the tire, the fabric being worn through by the constant rubbing. Bent rims are often caused by insufficient air pressure in tires, the liability to injury being increased when crossing tracks or bumps.

Old Shutter for Chicken Run

Because the older chickens consumed most of the feed, leaving little for the new-hatched ones, one farmer made a



Old Window Shutters Make a Good Chicken Coop That Will Keep the Larger Fowls Out

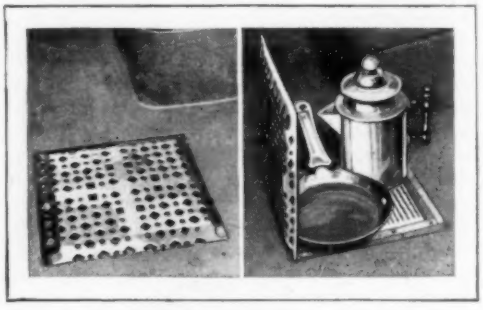
coop from four old shutters, as shown in the illustration. With the shutters wide open, only the small chicks can scramble through to the feed thrown in through the top, while the large chickens feed outside. When the shutters are closed, the chicks are protected from driving wind, and an old blanket is sometimes thrown over the top to make the coop comfortable. Later, as the chicks grow, some of the shutter panels are removed to permit their passage.—Dale R. Van Horn, Walton, Nebr.

Automatic Control for Homemade Refrigerator

I have constructed a couple of homemade refrigerators like the one described in the November, 1923, issue of Popular Mechanics. I made it unnecessary to go to the machine to start and stop the motor, by installing an automatic pressure-control switch. These switches may be bought at a cost of $8 to $15 and the installation is quite simple. Place a tee in the pipe leading to the high-pressure gauge and run a line to the opening tapped in the base of the switch. The wiring to the motor is changed and run to the line terminals in the pressure switch and the wires from the load terminals are connected to the motor. In operation, the switch is adjusted to kick the motor on and off, to keep the pressure within the desired limits, by turning the large screw on top of the switch until the desired adjustment is obtained. After the switch has been installed and properly adjusted, the outfit will require no attention other than an occasional inspection.—Leon D. Quick, Milesburg, Pennsylvania.

Cooking Food on Auto Heater

Nearly all modern automobiles are equipped with some sort of heater, especially if the car is of the closed type. I have a small sedan in which I installed a floor-type exhaust heater, as shown in the photo. The heater itself consists of a cast-iron body through which the hot gases circulate, and a perforated cover, which keeps passengers' feet or other objects from coming in contact with the hot surface of the heater. On most heaters this perforated cover is bolted solidly to the heater top. I removed the cover and riveted hinges on the edge next to the back seat, then fastened it to the heater top so that it could easily be swung up, leaving the heater top exposed. If the motor is run a few minutes, the heater top will become very hot so that, if the



Auto-Floor Heater That Can Be Used Effectively for Cooking Meals

cover is swung back and cooking utensils are put on the heater as shown, eggs, coffee and many other things can be cooked as well as on any common stove. I can boil a quart of water in four minutes with the motor running slowly. Of course, it costs a little more to cook this way than on a gasoline stove, but the big advantage is that it is always available and takes up no extra space. If the road is smooth, one can put a coffee pot on

and drive along until it is boiled. The pot can be prevented from being shaken off the heater by using a piece of wire to steady it. Altogether I have found this heater a very handy device on the road.—A. E. Granville, Cincinnati, Ohio.

Applying Wall Paint

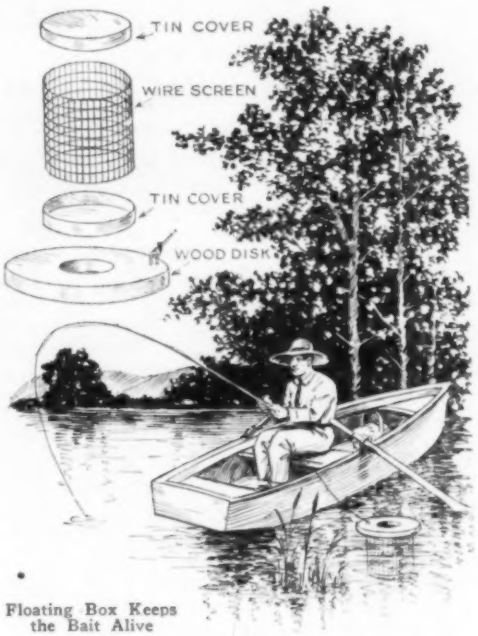
One of the most common reasons why many amateur jobs in painting fail is improper application, particularly in wall work. When painting walls, the amateur usually works horizontally across the wall from the ceiling down. It is impossible to do a good job in this way, as the laps can never be covered, nor can sufficient surface be painted in time to lay on an additional strip before the paint of the preceding lap has dried. The secret of success is to paint a strip about 2 ft. wide from the ceiling to the floor and cover this area well. The next lap can be painted before the paint of the first lap has dried and the edges of the laps will never be noticeable. This is quite a valuable hint as this method of painting does not require any particular skill and can be used with all colors.

Lighting the Gasoline Lamp

Many people have new gasoline lamps of the kind shown in the drawing. It is rather difficult to light them with matches and unhandy to do so with a torch made of paper. A better method is as follows: Bottles of shoe blacking in liquid form have a little brush attached to a cork. The sponge or batting on the end is pushed up, which leaves a hook on the end so that it can be hooked on the mantle. The batting is thoroughly saturated in kerosene, lighted and can easily be blown out after the gasoline vapor has been ignited.—Charles Latour, Jr., Plattsburg, N. Y.

Floating Bait Box

Fishermen will find the floating box shown in the drawing of considerable convenience as it is always within easy reach and, as it is submerged, keeps the minnows alive. It is made from a piece of ¼-in. wire mesh about 18 in. long and 6 in. wide, the ends being soldered together to form a 6-in. cylinder. Two 6-in. tin-can covers are soldered on the ends but before doing this the top cover is screwed to a wooden disk, cut from 1-in. material, and a 4-in. circular hole is cut through it and the tin cover, to permit getting the bait in and out. The box is tied to the boat by a cord attached to a staple in the cover.



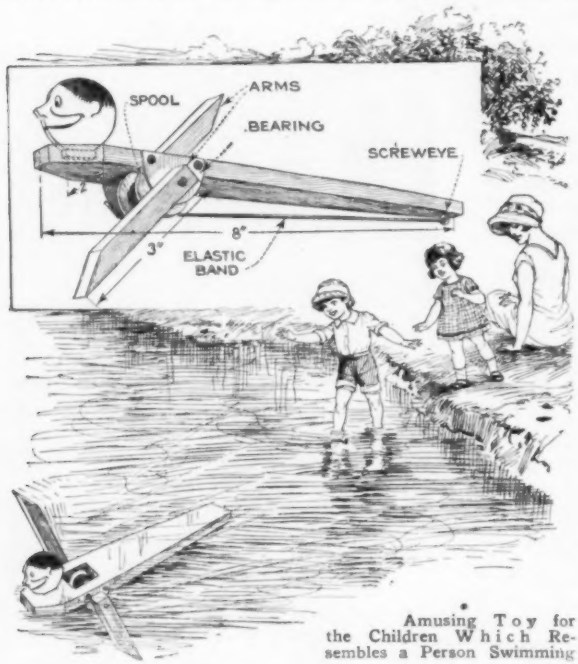
Floating Box Keeps the Bait Alive

Greasing Ford Ignition Systems

Special battery-ignition systems used on Ford cars have a casing at the lower end in place of the timer, which contains a pair of gears running in grease. It is a good plan to drill and tap a hole in this casing, at a point which will not interfere with the gears, and to install a grease cup or high-pressure fitting. Grease can then easily be forced into the casing when necessary. There is not much space back of the fan, so that care should be taken to place the grease cup where it cannot be struck by the fan.—E. T. Gunderson, Jr., Humboldt, Iowa.

How to Make a "Swimming Johnny"

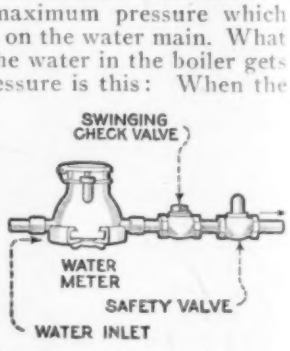
A "swimming Johnny" is an amusing toy, and one that any boy can build from odds and ends about the house. Properly assembled, it will travel several yards in calm water and can be used in the bathtub as well as outside. The body, cut from a piece of soft pine or cedar, is 8 in. long and 2 in. wide. Bevel the corners of what is to be the front end and taper the sides toward the rear as indicated. Cut out a head and taper the bottom down to a slender neck which can be fitted tightly into a hole an inch from the front of the body. Cut a square hole just back of the head to take a small spool as shown. On each side of the body screw a piece of brass or tin to serve as a bearing. Plug the spool, force a piece of stiff wire through the wood and fit the ends in the bearings, allowing them to project about ¾ in. The arms consist of two pieces of soft wood beveled on one end and the opposite ends are fitted securely over the ends of the wire axle. Be sure the bevel is uppermost when the arms are forward. Connect the spool with a long elastic band that passes below the body and attaches to a screweye near the rear end. This should be just taut when the spool is unwound. Paint the device any suitable color and oil the spool and the wire in its bearings. The head can be painted any design desired. Wind up the elastic on the spool until it is quite tight, being sure to wind the arms to the right when the head faces left. Place "Johnny" in the water and let go of the arms. They will thrash around in an overhand stroke and push the toy ahead at a good speed.—L. B. Robbins, Harwich, Massachusetts.



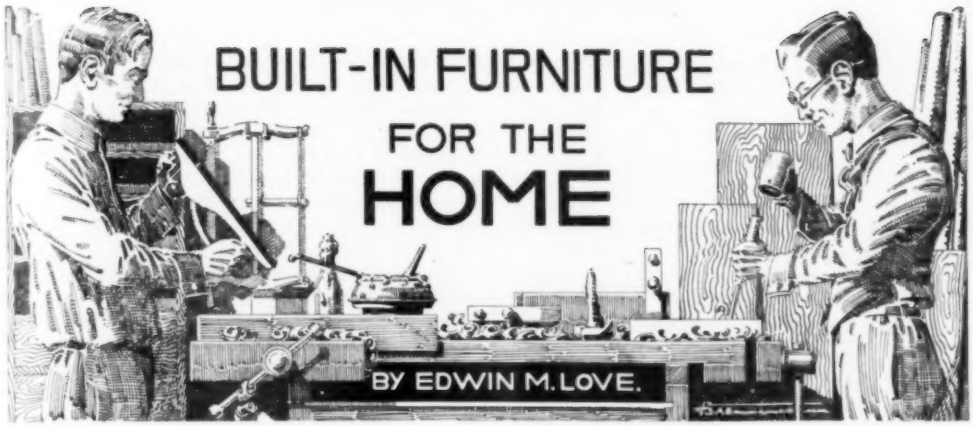
Amusing Toy for the Children Which Resembles a Person Swimming

Protecting Water Meters

Hot water is now being obtained during the winter months from many hot-air furnaces by inserting a pipe coil into the fire box, which in turn is attached to the boiler. It happens in the majority of well-designed jobs that the water is overheated during very cold weather, which produces steam and causes considerable pressure on the water-supply line, forcing the water to back up through the meter. This ruins the meter for future operation. The practice of obtaining hot water from the furnace cannot then be continued unless some method of protection for the meter is provided. In the accompanying illustration is detailed an arrangement of two inexpensive fittings, which can easily be installed. On the house side of the meter, install a horizontal check valve and immediately behind it a small safety valve, set to the proper pressure. Setting this valve is not difficult. It should be set about 5 lb. above the maximum pressure which has been known on the water main. What happens when the water in the boiler gets up excessive pressure is this: When the pressure on the boiler overcomes the pressure on the water line, the check valve closes and the safety valve opens taking care of the boiler and at the same time saving the cost of a new meter.—L. H. Georger, Buffalo, N. Y.



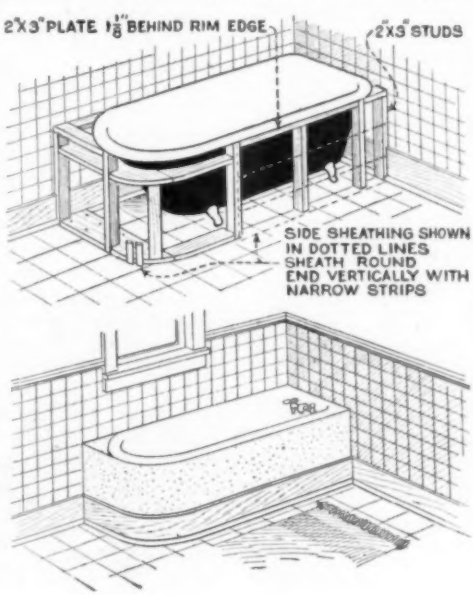
¶A double-filament headlight lamp can be used again for a tail light after the bright filament has burned out, by dropping solder between the two contacts, which makes it a single-contact lamp.



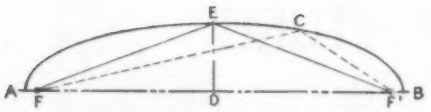
Part XVII—Building In Bathtubs

THE four-legged bathtub is rapidly becoming obsolete. Housewives rightly condemn it as unsanitary and productive of unnecessary labor. The high-priced tubs having porcelain aprons extending to the floor are ideal, but the expense of replacing the plain tub is prohibitive to many. However, any handy man can house in a tub for plastering or composition surfacing; and tubs of almost any shape, whether installed in a new house or long in service in an old home, can be inclosed, to the great increase of beauty and cleanliness.

For a round-end tub, plumb down from the edge to the floor and draw a line 1½ in. behind that point on the floor. Against the end wall, nail a 2 by 3-in. stud, suitably tapered to fit under the rim. Where the curve begins, put up another stud and, between the two, nail a wedge-shaped 2 by 3-in. plate. Put a third stud under the plate, midway between the others. Keep them plumb. Sheath with 1 by 6-in. stock, run horizontally, the upper board wedging tightly behind the tub rim. To obtain nailing for the end sheathing, it is necessary to cut segments of circles from 1-in. stock to a radius 1⅛ in. shorter than that of the tub end. Nail one set to the floor after having plumbed down from the rim and measured 1½ in. back for points on the curve. Another curve, fitted roughly to the tub at a distance 4 in. below the top, is supported by two short studs cut underneath, while the ends are nailed into the side stud. These curves may be continued around the end of the tub toward the wall, or may be built out straight from the center, the end housing meeting the wall at right angles. Sheath with narrow vertical strips braced against the rim. If it is desired to plaster the tub, set the studding back from the rim only ¾ in. In this case it is advisable to use waterproof cement for plastering, although the hardwall plaster, well enameled or covered with oilcloth, is fairly satisfactory, particularly if a thin band of wood is run around the rim, covering the joint with the plaster. Such a band should be coated on the back with thick white lead before nailing in place, to prevent water from working behind it.

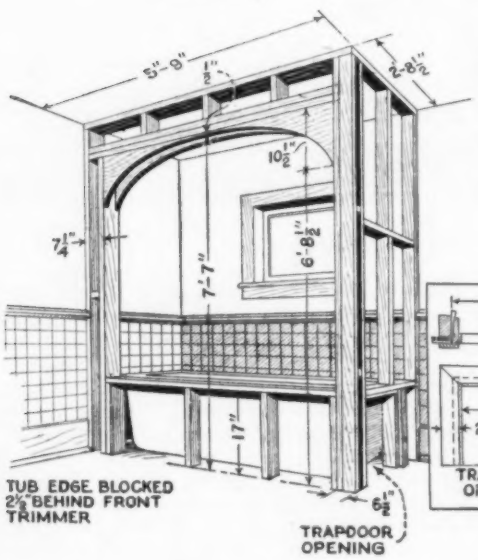

2"X3" PLATE 1⅛" BEHIND RIM EDGE
2"X3" STUDS
SIDE SHEATHING SHOWN IN DOTTED LINES SHEATH ROUND END VERTICALLY WITH NARROW STRIPS

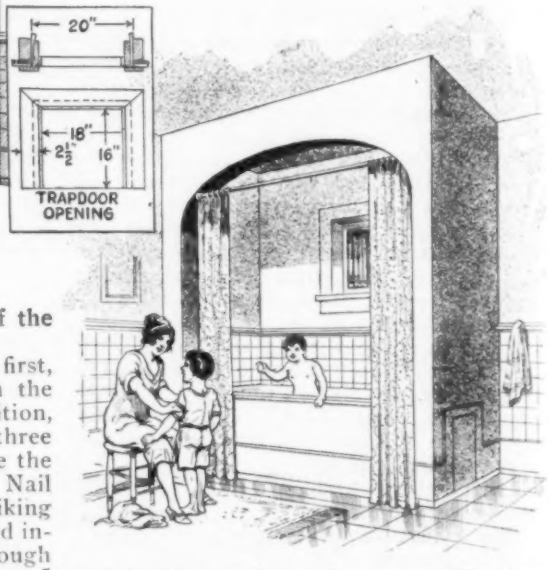
A tub, with or without a side apron, built into a recess in the bathroom is illustrated in the drawings. At the free end, a wall is built to the ceiling and returned on the face of the tub to make a post 8 in. wide when plastered, while a pilaster of the same width is built against the end wall. Between these is plastered an ellip-



FC+CF¹=AB; AD=BD=FE=EF¹=FE+EF¹÷2

LAYOUT OF ELLIPSE





tical arch, beginning at the height of the door (usually 6 ft. 8½ in.).

Build the arch or the end partition first, according to the direction in which the ceiling joists run. For the end partition, cut a plate, 2 ft. 7½ in. long, and cut three 2 by 4-in. studs long enough to force the plate tightly against the ceiling. Nail one at each end of the plate by spiking through the latter. The third is nailed inside the corner stud with thick enough blocks separating them, to form a post 5 in. wide. Nail a trapdoor header 1 ft. 5 in. from the lower ends, if the fixtures are on that end of the tub, and cut a fourth between it and the plate. Raise to position and plumb carefully before nailing the plate to the ceiling. If there is not enough room in the bathroom to allow the end wall to be raised in this manner, nail up the wall stud and plate and put up the studs one by one, toenailing them with eight-penny commons.

Plumb up the end wall 2½ in. in front of the edge of the tub, and nail up a wall stud and the plate. Make a double header of 2 by 4-in. stock, well spiked together, to nail between these wall and corner studs. Level it and nail three short studs above. Trim the sides by nailing one stud against the corner post and blocking another from the wall stud, so that, when plastered, the posts of the arch will be of equal width, as shown in the drawing. It is necessary to fit these studs around the front of the tub. If the tub has no apron, but is to be plastered or tiled in front, stud up under the rim, as shown in the drawing, for the round-end tub. For tile, the rough work should be 1⅛ in. from the rim edge. Tar paper and heavy wire or metal lath over this are used to key the cement backing to the tub.

Fit a splash apron of 1 by 6-in. baseboard around the top of the tub, setting the lower edge in heavy white lead; or remove the lath and plaster to the desired height and cut between the studs 1 by 6-in. stock, 1⅛ in. back from the face of the plaster, for a tile apron. To draw the elliptical curve, lay out on a floor a straight line equal to the width of the rough arch, and at the center erect a perpendicular equal to the desired height of the curve. Tie loops in the ends of a string of fine wire, which, when stretched, will have a length equal to AB in the diagram, the width of the rough arch. With one-half of AB as a radius, and E, the top of the perpendicular, as a center, strike arcs through AB with a pencil point in the loops, giving the foci F and F¹. Drive brads in these points, loop the string over them, and trace along the string with a pencil on a piece of cardboard laid underneath. Only one-half need be traced, as the pattern can then be cut out and reversed for the other half. Make four brackets, allowing ½ in. of stock above,

but cutting the ends tangent with the curve. Nail these under the header, keeping them back a lath thickness from the faces of the studs; then tack on pieces of lath to fur out the side lath for key space for the plaster, and lath square across the thickness of the arch. Stretch a strip of metal lath of wire mesh, 18 in. wide, around the thickness of the arch and nail close together to take out all puckers or wrinkles. Put metal corner beads on the straight sides, plumbing and gauging them for thickness of the partition.

Trim the trapdoor opening to 1 ft. 8 in. in width, and make a jamb, 1 ft. 4 in. high by 1 ft. 6 in. in width, using 1 by 4-in. stock. Rabbet the head jamb into the sides. Set with the sides plumb and the head level, front edges projecting ¾ in. outside the studding, forming grounds for the plaster. After plastering, miter around a flush casing of 1 by 2-in. stock, and 1⅛ in. behind the face, nail stops of ⅜-in. material. Make a panel door of 1⅛ by 3-in. stock and fit into the opening. Secure with two small brads driven through the stiles into the jambs. This is to enable a plumber to work on the pipes in case of stoppage or other trouble.

Cut blocks between the studs to stiffen them, and the frame is ready for lath and plaster. Since the beauty of the arch depends on the smoothness of the curve, see that the plasterer does not turn the curve into the arc of a circle by pointing the ends and flattening the adjacent curves.

MATERIAL LIST

Recess Tub	Round-End Tub
3 pieces, 2 by 4 in. by 14 ft., pine or fir, S1S1E.	1 piece, 2 by 3 in. by 14 ft., pine or fir, S1E.
2 pieces, 2 by 4 in. by 16 ft., pine or fir, S1S1E.	3 pieces, 1 by 3 in. by 10 ft., pine or fir, S1E.
1 piece, 2 by 4 in. by 8 ft., pine or fir, S1S1E.	1 piece, 1 by 6 in. by 14 ft., pine or fir, S1E.
1 piece, 1 by 8 in. by 6 ft., pine or fir, S1S1E.	1 piece, 1 by 4 in. by 14 ft., pine or fir, S1E.
1 piece, 1⅛ by 3 in. by 6 ft., pine or fir, S4S, sanded.	Cost of materials, about $1.50. Time to build, about 6 hours.
Cost of materials, about $3. Time, about 8 hours.	

Making Round Rods for Fish Poles

In looking forward to the enjoyment that may be had in the spring, it is well to prepare and overhaul the fishing apparatus or the shooting equipment. In doing so, it may be necessary to make a joint for the fish rod or perhaps a rod for the gun. These can be easily cut if they are sized and run through holes made in a piece of thin metal as follows: Make several holes of the desired sizes in a steel plate, and ream them out with a rather dull taper reamer, so as to leave a bur on one side. This bur should be filed down almost level with the surface of the metal, leaving the edges flat and sharp. If a rod of wood from which the article is to be made is put in a hole and drawn through from the opposite side to the bur, a nice round rod will result. As the rod becomes smaller, use a smaller hole until the required diameter is obtained. A saw blade that is not too thin is about the proper thing to use for the steel plate. It will be necessary to draw the temper to make the holes, but it is not necessary to retemper it after the holes are made.

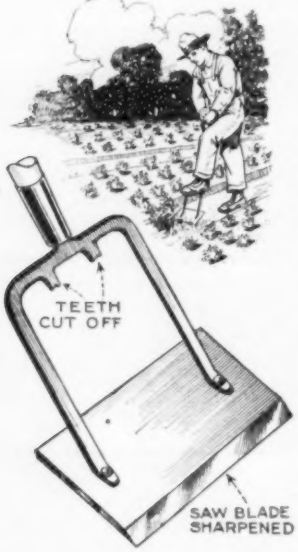
Saving Stain in Treating Shingles

Staining shingles is usually accompanied by a considerable waste of stain because the shingles are laid aside after dipping and the excess stain drips onto the ground. A method of doing this work with minimum waste is shown in the photo. The dipped shingles are laid in a trough so that the excess stain will run back into the container. A good trough for this purpose can be made by nailing together two pieces of wide board, about 6 ft. long, and arranging a pair of legs at one end. The other end is placed over the edge of the stain barrel or can. By this means practically no loss of stain will be suffered.

Trough for Holding Freshly Stained Shingles Prevents Waste

A Good Garden Weeder

After breaking a tine out of his potato or spading fork a neighbor of mine made a handy weeder out of it by removing the other middle tine and riveting a piece of old saw blade across the points, as shown.



With the two remaining tines bent to a slight curve, and the blade sharpened, the implement is used much as one would use a shovel, slicing down the weeds without any earth collecting on the blade. Small holes are drilled through the ends of the outside tines and the saw blade beveled as indicated. Its shape can be altered to suit the user. The rivets are set midway between the edges of the saw blade and hammered down tight. The blade can be sharpened on an emery wheel and later finished with a fine file or oilstone. The maker says much more ground can be covered with this tool than with a hoe, and that it makes the operation far less tiresome.—Dale R. Van Horn, Walton, Nebr.

Testing and Caring for Files

To test a file hold it so that the light will be reflected sharply from the teeth and observe whether their edges are flattened and appear as white lines. If so, the file is dull and should be recut if of considerable size and value.

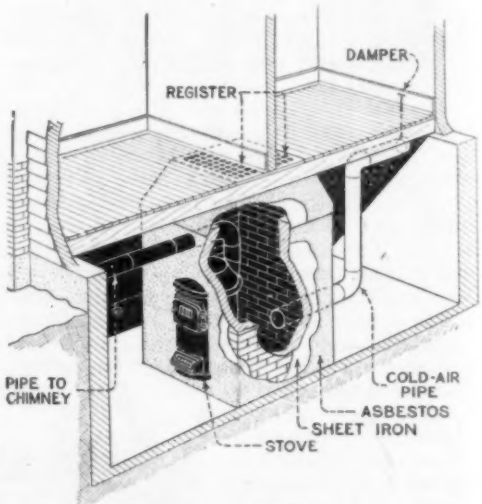
Files should not be thrown into drawers and mixed with other tools, but should be set in racks or drawers made for the purpose. A mechanic would not throw a straightedge into a drawer containing other tools, and a file should be given similar consideration, as every nick in the teeth impairs the efficiency of the tool.

Files may be sharpened by dipping them into sulphuric acid, but care must be taken not to permit the acid to come into contact with one's clothes or person. Water is used to wash off the acid.

Each should be provided with an individual handle. This prevents injury to the hand of the worker and aids in the proper use of the file. Handles should be carefully fitted and be made of a size proportionate to the file. In removing a handle from a file, strike the handle at the end nearest the file, by sliding a piece of hard wood along the surface of the file, as the blow is struck with it. Do not use another file or metal object in thus removing a handle, as it will injure the latter.

Stove Forms Homemade Furnace

The renter of a small home had no furnace, so he planned a method of providing heat for the house at a minimum cost. There was a small pit under the dwelling. He obtained a stove at a secondhand store, and a lot of bricks that had been discarded from a wrecked building. He purchased a large hot-air register, some lengths of stovepipe, sheet iron, asbestos paper and cement. With these materials, costing less than $10 all told, he built a satisfactory furnace, which worked well all through the winter. The register was first placed in



Improvised Hot-Air Furnace Made from Old Stove and Discarded Bricks

the floor, between the living and dining rooms. The stove was placed in the basement and walled up with brick on all sides leaving only the doors in front exposed, as shown in the illustration. A pipe connected the stove to the chimney and another line of pipe ran from

the bottom of the hot-air chamber to the top of the ground, thus insuring plenty of air. A damper, set in this pipe, regulated the amount of draft. When this had been done, the brick walls were connected to the register with sheet iron covered with asbestos paper. This is a good way for those without proper heating facilities or without sufficient cash to obtain a good furnace.

Backstop in Garage Prevents Damage

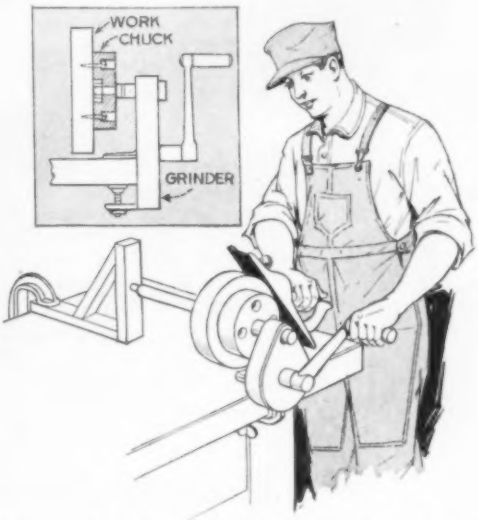
Some garages for automobiles are only a little longer than the car and there is then danger of running up against the wall so that both car and garage may be damaged. One driver built an up-sloping platform at the rear end of his garage so that the front wheels would strike this, stopping the car effectively without any danger of damaging it. This installation is especially recommended for inexperienced drivers.—Charles Latour, Jr., Plattsburg, N. Y.

Bedroom Sandals Made from Paper Bags

Bedroom sandals are not always at hand, but a dozen pairs of paper sandals, which will serve just as well as the more expensive article, can be made for just a few cents. Ordinary bags, obtainable at a grocery store, are used, the size depending on the size of the foot for which they are intended. The bag is cut away at the top on one side, as shown in the lower detail of the illustration, to fit over the instep. If the paper is stiff and the edges seem sharp, they can be folded over. These sandals keep the feet clean and may be thrown away after use.—L. B. Robbins, Harwich, Massachusetts.

Makeshift Lathe for Emergency

In the absence of a small wood lathe, a satisfactory substitute for some work can be made from a grinder as shown in the drawing. The emery wheel is first removed and a wooden wheel substituted,



Improvised Lathe Found Useful in the Small Workshop

which serves as a faceplate on which the work is fastened with screws. A wooden brace, clamped to the bench top with a C-clamp, serves as a tailstock. An ordinary plane can be used as a cutting tool, while the grinder is operated by hand.—B. C. Shilling, Walton, Ind.

Cheesecloth Takes Place of Glass for Storm Doors and Hotbeds

For poultry houses, storm doors and hotbeds, a good substitute for glass can be made by taking cheesecloth or any lightweight muslin and ironing paraffin into it. An electric iron does a fine job, but care must be taken not to let the iron get too hot or the cloth will be scorched. After it is treated in this way, it becomes nearly transparent. This treatment also makes the cloth waterproof.

¶When new lumber, particularly white pine, contains many knots, it is good policy to use less oil in the paint, substituting turpentine for the oil eliminated; oil in paint causes later coats to draw the sap out of the knots, and this naturally leads to bad checking, but the substitution of turpentine for some of the oil prevents this.

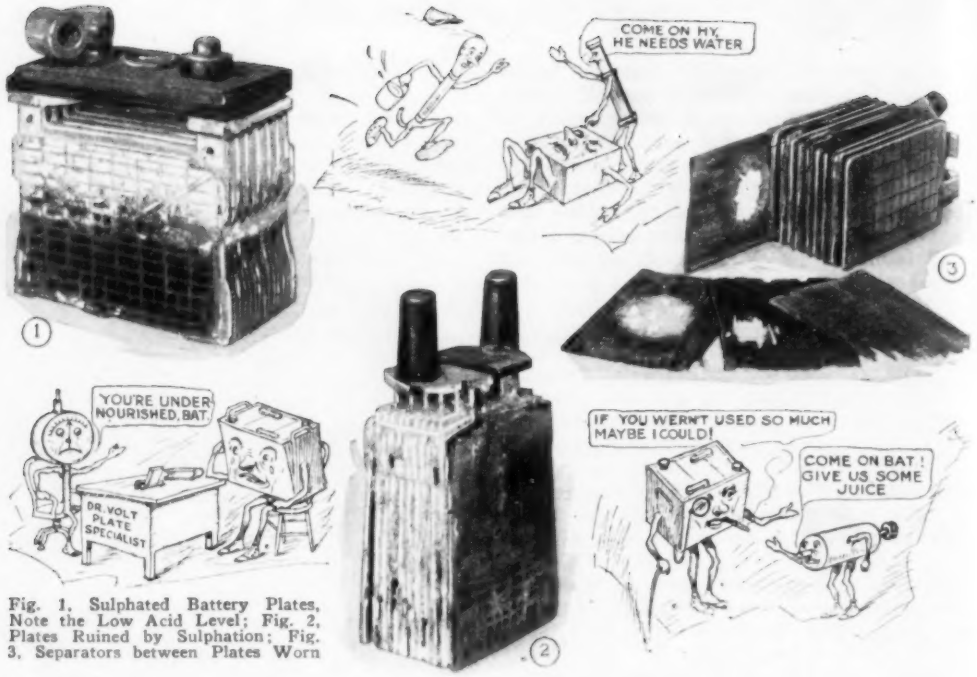

COME ON HY, HE NEEDS WATER
YOU'RE UNDER NOURISHED, BAT
DR. VOLT PLATE SPECIALIST
IF YOU WERN'T USED SO MUCH MAYBE I COULD!
COME ON BAT! GIVE US SOME JUICE
1
2
3

Fig. 1, Sulphated Battery Plates, Note the Low Acid Level; Fig. 2, Plates Ruined by Sulphation; Fig. 3, Separators between Plates Worn

How to Save Your Battery

The Little Black Box under the Seat Is the Heart of the Car; It Takes Only a Little Care to Keep It Healthy

DEAD battery! All motorists know what that means. It usually happens just when the driver is farthest from a service station or just when he is in a hurry and can least spare the time to lug it to the station to rent one. Yet most motorists are themselves to blame for the run-down condition of the "box of juice," because they will not spare the little time required for its proper upkeep. Even in summer, when the water in the battery evaporates fastest, it is not necessary to look at the battery more than once a week to see that the water level is maintained. This takes only five minutes, yet we find owners who think it "too much trouble" to do this, and allow the water level to get down so far that the battery is seriously damaged before they will look at it.

There is no need to study the storage battery deeply in order to take proper care of it. Simply knowing how to use a hydrometer is enough—if the hydrometer is used. A storage-battery hydrometer syringe can be bought from any auto-supply house cheaply, and a bottle of distilled water for 15 cents at any drug store. With these the owner is equipped to add months, and sometimes years, to the life of the battery. The hydrometer syringe has a small float inside of it; this is the hydrometer proper, and is marked or graduated to indicate the specific gravity of the acid solution in the battery. As the specific gravity depends directly on the state of charge of the battery, the hydrometer tells the owner all he needs to know about its condition. To take a "gravity reading," remove the cap from one cell of the battery, squeeze the syringe bulb and insert the end of the rubber tube of the syringe into the liquid in the cell (this liquid is called the electrolyte). Now release the bulb and the electrolyte will be drawn up into the glass tube. Draw up enough to float the hydrometer. The latter will float in the electrolyte at a height dependent on the specific gravity, and the mark on the scale of the hydrometer even with the surface of the liquid is the "battery reading." After reading the scale, press the bulb and discharge the electrolyte back into the cell from which it was taken. Don't neglect this; never put electrolyte taken from

one cell into another. Read all the cells. Don't depend on the reading from one or two cells only. If the reading is down around 1.160, have the battery charged immediately, and never permit the battery to become discharged below this point. The following readings indicate the state of charge of the cells: 1.275 to 1.280, fully charged; 1.260, three-quarters charged; 1.225, half charged; 1.160, quarter charged. A cell is completely discharged when the reading is 1.125.

If the readings of the three cells are the same within 20 points, that is .020 degrees on the hydrometer, then all three cells are running together in good order. If one cell indicates more than 50 points below the other two, this is an indication of a partial short circuit in that particular cell, and the battery should be placed in the hands of a good repairman at once.

It is a good plan to make it a rule to test the gravity of the battery once a week, summer and winter. The level of the electrolyte in the cells should be inspected once a week in the summer anyway, and, as most people use the hydrometer syringe to put water into the cells, it only takes a couple of minutes more to take readings from the cells. If the habit is formed of inspecting the battery on a certain day, it becomes automatic and no trouble at all; therefore, keep up the weekly inspections throughout the winter so as not to break the regular routine, and spoil a good habit. The level of the electrolyte should be maintained ½ in. above the plates, as shown in one of the illustrations, and pure distilled water only should be added. Never, under any circumstances, add acid; this is a job for the repairman, should it ever be necessary.

All this seems a lot of care when it is set down in black and white. As stated before, however, it takes but a few minutes a week; and if it is neglected—look at the illustrations! Fig. 1 shows the effect of neglecting the level of the electrolyte. Sulphate of lead forms on the plates when left for a time in a discharged condition, and it will form much more rapidly on the plates that are not protected by the electrolyte. The low acid level in this particular cell can be seen very clearly marked on the plates. This meant a job for the repairman, and expense for the owner. Now look at Fig. 2. These plates are very badly sulphated, and this was caused by letting them stand after the electrolyte was spilled. The battery

Fig. 4, Buckled and Broken Plates, Due to Overcharging and Vibration from Loose Battery Clamps; Fig. 5, Plates Ruined by Overheating

should have been refilled and charged immediately. When the plates are sulphated, a long, slow charge is necessary to dissolve the sulphate, as much as four or five days being required in many cases. This explains why your battery station was so long in charging your battery the last time, perhaps, and you shouldn't have been sore about it. It was all your own fault. Impure water containing minerals, when used in the battery, also causes it to be very slowly charged, as the salts clog up the pores in the plates. Sometimes it will not charge at all, so don't take a chance on anything but distilled water.

It is a good thing, when you have driven your car for a while and know about the average speed that you like to drive, to go to the battery station and have them adjust the charging rate of the generator to suit your driving habits. If, for example, you drive mostly in the daytime, and very little at night, then the charging rate of the generator will probably be too high. If the electrical system is not regulated correctly and delivers more current than the battery can absorb, something is certain to be damaged by that excess. This is generally the positive plates of the battery, and opening the cells will show this condition by the burnt and loosened active material and the buckled and loosened plates. See Figs. 4 and 5. In this case, the charging rate should be lowered. If, on the other hand, most of your driving is done in the evening, or if you must start and stop the motor often, the charging rate should be increased to keep the battery properly charged.

The following incident illustrates how the charging rate depends on the driving habits of the owner. A car was used constantly, but was not started or stopped often. The battery could never be made to come up to more than half charge by means of the generator, and yet the battery and generator were in good order, as far as the service station could see. After riding with the owner for a few trips, a friend found the trouble. The automobile charging generator is designed to deliver its maximum output around the average driving speed, 25 to 30 miles an hour. Above this speed the charging rate begins to fall off rapidly. The generator on this car had been set, as are most of them, to give 10 amp. at 25 miles an hour, as the service man did not know, of course, what the driving habits of the owner were. As a matter of fact, according to the friend who diagnosed the trouble, the owner didn't know what 25 miles an hour felt like, except in traffic; his average speed was close to 50 miles an hour, and up to 65, just the range in which the generator output had fallen to the minimum. When the charging rate was adjusted to suit the owner's driving range, the trouble disappeared.

Then in the winter the demands on the battery are more severe. The car is harder to start, the lights are used for longer periods, and the battery is not quite so efficient in cold weather as in warm. It will often be found necessary to boost the generator output to take care of the additional drain on the battery. Have your service station do this. Be especially careful to keep the battery fully charged, not only for your own comfort in starting, but to prevent it from freezing. A fully charged battery will not freeze until the temperature reaches 95° below zero, but a battery that is only quarter-charged will freeze at zero, and a fully discharged battery will freeze at 13° above zero. Be as easy on the battery as conditions will admit. Prime the engine before starting up from cold, and turn the engine over a few times with the hand crank before stepping on the starter. In summer, the main precaution to take is to keep up the level of the electrolyte, as evaporation is faster than in cold weather.

When on a long drive, it is expedient to burn the lights in the daytime in order to prevent overcharging the battery and consequent danger of buckling the plates. Have the service station check up on the charging rate of the battery again, especially if this has been boosted for the winter, and reduce it again to the proper rate for summer driving.

It will pay you to take care of your battery, for new ones are an expensive item, and a good battery can be ruined in a very few months by lack of attention.

Screen Holder for Shipping Tags

In shipping poultry and eggs, where crates and cases are returned empty to the shipper, the removal of tags and changing addresses is quite a task. This difficulty is easily overcome in the following way: A number of

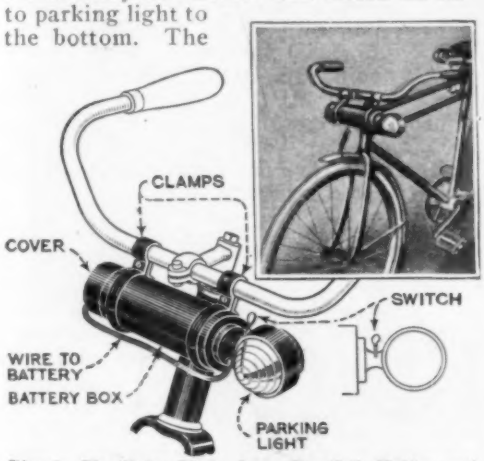
pieces of wire screen, 4 by 6 in. in dimensions, are creased and folded on the lines indicated in the drawing. When tacked in place, one upon the end of each crate or case, they provide pockets for the easy insertion of the shipping tags, and a single tack through the eye of each tag holds it in place. To change the name and address, the commission dealer merely has to remove one tack and replace it after reversing the tag and putting it back into the pocket.—G. E. Hendrickson, Argyle, Wis.

Coal Ashes Save Fence Posts

A farmer, having observed that the growth of grass and weeds around his fence posts held the moisture and caused the posts to decay at the ground line, prevented this trouble by tamping ashes into the ground for several inches around them. When building fences, he carried a barrel of coal ashes in his wagon, and, after a new post was driven, packed in the ashes. This prevents the growth of vegetation around the post and allows the sun and air to dry the soil quickly after a rain.

Bicycle Headlight

Any boy can easily make the dry-cell lamp shown in the illustration. Obtain a metal dry-cell holder and fasten an auto parking light to the bottom. The



Bicycle Headlight Made from Dry-Cell Holder and Auto Parking Lamp

lamp should be of the type having a switch. The wires are brought through the cover and connected to the lamp. A pair of clamps are made of strap iron by means of which the dry-cell box is attached to the handlebars in the position indicated in the drawing.

Floating Hunter's Suit

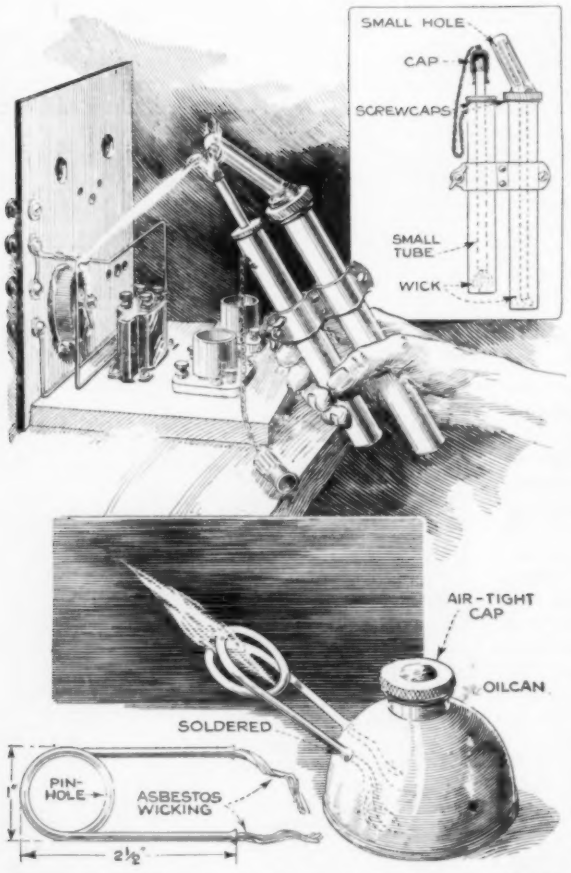
During the duck-hunting season the floating suit shown in the photo has been found very satisfactory by a California

Duck Hunter's Novel Floating Suit Found to Be Very Practical

hunter. It consists of a large inner tube, a pair of high rubber boots and a piece of sheet rubber, which is cemented to both inner tube and boots. This arrangement permitted him to float safely without getting wet and allowed free movement of the arms and hands.

Dressing for Fishline

A quick-drying dressing for fishlines may be prepared as follows: Mix equal parts of boiled linseed oil and gold sizing; apply this to the line in a moderately thick coat. Dressing which will not dry as rapidly but which will resist the water as well is made by melting together 4 parts of paraffin and 1 part of rosin. Melt the paraffin in a deep metal vessel over a small fire, and add the rosin after the paraffin has dissolved. Care must be taken not to permit the fire to come into contact with the mixture. Allow it to cool slightly and then coil the line in the vessel. Draw it through a piece of wet sponge held between the fingers. This will cool the mixture rapidly and the line may then be stretched and polished with a wet rag.—A. E. Tetu, Ottawa, Canada.

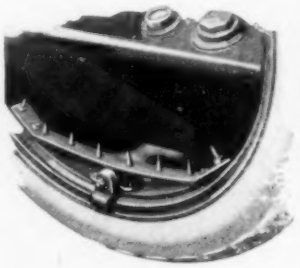


Homemade Self-Blowing Alcohol Torches Produce Considerable Heat and Are Useful for Small Work

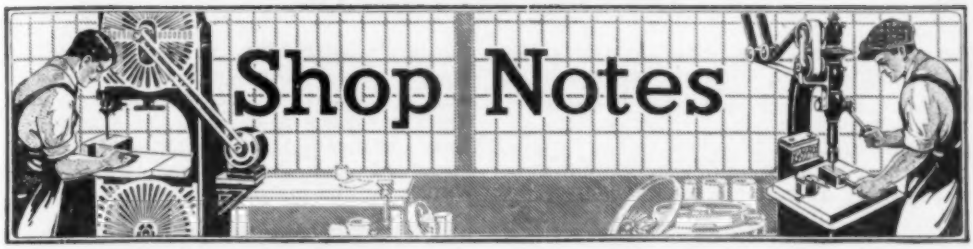
Self-Blowing Torches

For such work as soldering wires, etc., a small self-blowing torch will be found very useful. The torch shown in the upper detail is made from parts of an old bicycle pump. The two tubes are held together with the regular clamp supplied with such a pump. Screwcaps are fitted to the upper end of each container. A hole is drilled through one of these clamps for ¼-in. copper or brass tubing, which extends nearly to the bottom of the container, and has a wick pulled through it. A cap is provided on the open end and a length of chain, soldered to both the cap and the container, prevents the cap from being lost. The open end of a dust cap from an auto-tire valve is cut off at an angle and is soldered to the screwcap of the other container, this cap having a hole drilled through it. A pinhole is drilled in the upper end of this cap, as indicated in the upper right-hand detail. A length of ¼-in. tubing is soldered inside of the cap and is bent to extend to within ½ in. of the bottom of this container. A wick is also pushed through this tube. Both containers are filled with alcohol, the wick is lighted as shown and the torch is held at such an angle that the flame heats the end of the adjacent cap. This causes the alcohol inside to evaporate and the gas thus formed has no other outlet than the pinhole, provided the screwcap is turned down tight. A rubber washer should be used under each screwcap to assure air-tight seating. The containers are adjusted so that the flame will effectively heat up the cap when the torch is being used with the result that a constant pressure will be maintained. The lower detail shows another small torch, which operates on the same principle but is easier to make. It consists of the body of an old oilcan provided with an air-tight cap. A length of copper tubing is bent to the shape shown and is filled with asbestos wicking. The ends of the tubing are soldered into two holes drilled in the side of the can, and the wicking should project far enough to take up alcohol, with which the can is filled. A small pinhole is made at the point indicated. The coil of tubing is first heated with a match to produce pressure inside, and as soon as the flame starts, this pressure will be maintained, since the forward part of the coil is kept constantly hot.

Stopping Spare-Tire Rides



Many boys have the habit of stealing rides on autos by hopping onto the spare-tire holder at the rear, which is a very dangerous practice. To prevent this one auto owner bolted a short length of spiked guard, such as used on fences, to the inside of the tire holder as shown in the photo, and found it very effective.



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How to Treat Plastic Paint

By J. S. HAGANS

PLASTIC paint is a gypsum product marketed under the name of textone, which has some of the characteristics of the gesso that is now having a renaissance among home art workers. This material, which can be used for obtaining much broader effects just as well as it can for the finer gesso applications, is to be had at most paint stores and building-supply sources. While primarily produced as an architectural material, this fact does not necessarily limit its uses for building purposes, although it is here that its application will perhaps have the greatest appeal. This material comes in standard-size 10 and 25-lb. packages in the form of a white powder. It is not a plaster in any sense, but a true plastic paint. The addition of lukewarm water and coloring pigment, if desired, is all that is necessary to its application with an ordinary paint-brush. One pound of

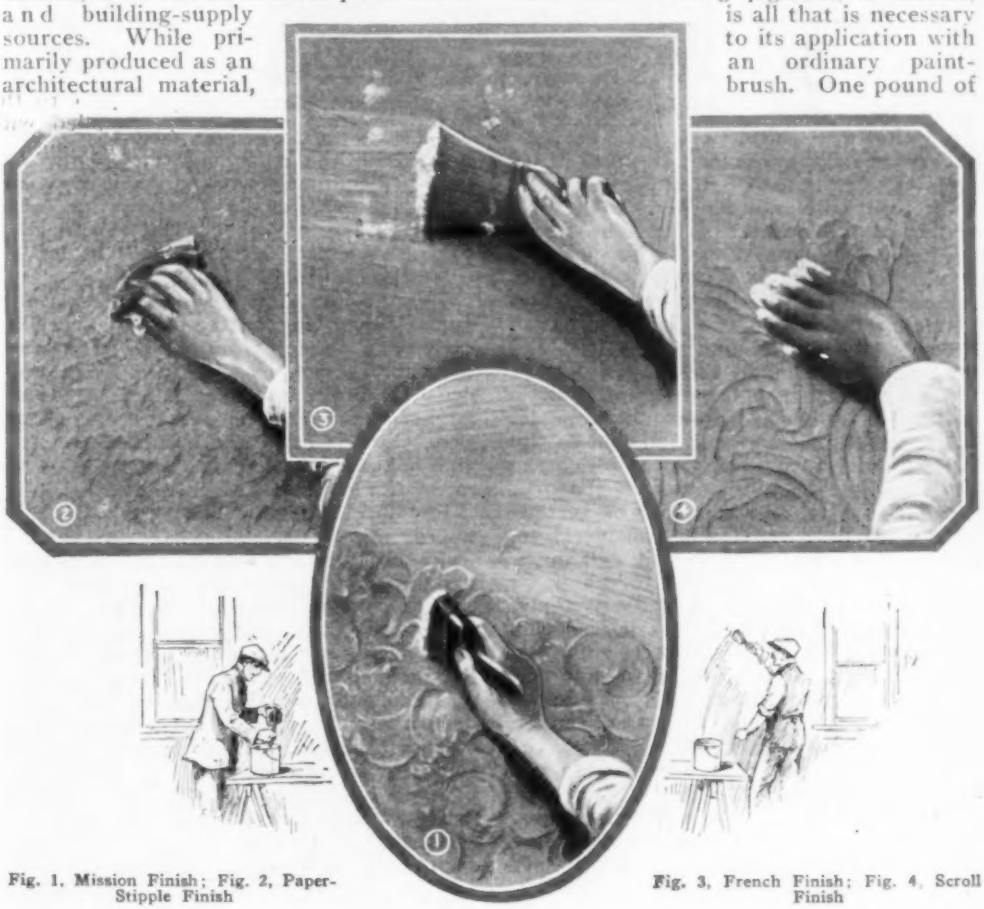


Fig. 1, Mission Finish; Fig. 2, Paper-Stipple Finish

Fig. 3, French Finish; Fig. 4, Scroll Finish

the material will cover approximately 1½ sq. yd. of surface, or about as much as ordinary oil paint. It can be applied over any surface and a wide variety of charming and distinctive effects are within reach of any reasonably intelligent person capable of using a paintbrush.

Avoid Prussian blue, carmine and aniline colors. While chrome green and yellow can be used, the decorator must handle them carefully and limit the quantities. It is important that the pigment first be dissolved and then added to the previously mixed material.

Fig. 5, English Finish; Fig. 6, Stipple Finish, Using Brush; Fig. 7, Brush Finish

The richly attractive stone and rough-surfaced wall effects one sees in window backgrounds, wall finishes and surfaces on fixtures, polychrome or otherwise, if they haven't been obtained through the use of textone, can be. Therefore, the storekeeper, the home owner or the artistic person who wants to polish up something in an original way, will find in this material a very flexible medium that is susceptible of all sorts of manipulation.

Aside from the material itself, the only thing needed in the way of equipment is a paintbrush, large or small, as the surface to be worked upon may demand.

Use a 12-qt. water pail and add to the powder lukewarm water, from which the chill has just been removed, in the proportion of 1 pt. of water to 1 lb. of textone. Do not, under any consideration, attempt to mix it thin like calcimine. Allow the mixture to stand for about 30 minutes, after which it is ready to apply.

If a one-coat tinted effect is desired, this mixture can be colored to certain shades. The following pigment colors ground in oil, and slightly thinned with turpentine, or dry colors dissolved in water, can be safely used: For red, use Venetian, Indian or permanent reds; for browns and tans, use raw umber, burnt umber, raw sienna, burnt sienna; for yellow or creams, use yellow ocher; for blue, use cobalt or ultramarine blue; for green, cobalt green; for black, use lampblack or dropblack.

It is necessary that sufficient textone should always be prepared to complete the job, in order to insure the same color. Incidentally, it would be well to experiment with the color before applying to the surface to be worked, as it may be too dark or too light when dry. In either case, the proper effect can be obtained by adding either more textone or color, as required.

This plastic paint may be successfully applied over any surface, if the user is careful to remove from it all dirt, grease or efflorescence, so that it is clean and dry. Generally speaking, it will be found advisable to give the surface a coat of size, which is furnished with the material as it is bought, and this should be allowed to dry for six hours after application.

For finishing over sheet-rock plasterboard, or any of the other varieties of wallboard, be sure that all the joints and nail heads are completely concealed and that the surface is in a level plane at the joints. Textone cannot be successfully used over gloss oil or varnish sizes, and their use should be avoided for this work.

On new or old plastered surfaces, not decorated, the plaster must be at least two months old. If the plaster finish is found to be unusually soft or absorbent, proceed as follows: First, get a good grade of floor varnish and mix with an equal part of turpentine. Then mix this liquid with textone in the proportion of 1 lb. of the powder to 1 pt. of liquid, and

apply as a sizing coat. When this is thoroughly dry, remove the sharp "nibs" with sandpaper and apply the previously prepared material. Where the plaster finish is normally hard and not too absorbent, sizing is not required.

A hard, smooth plaster surface is sometimes difficult to cover. In this case, apply a preliminary coat of textone, well brushed out; allow this to dry and then apply the regular preparation.

The plastic paint may be applied over a coat of brown plaster after it has been darbied to a true surface, troweled smooth and sized.

For application over painted surfaces, scrape off all loose and scaling paint and fill cracks and holes to a level surface. When dry, sandpaper smooth and color patches to match surrounding surface.

Great care must be taken to see that all grease, dirt or wax is thoroughly removed. If the surface, after being thoroughly cleaned, looks glossy or enameled, kill gloss with a 10-per-cent solution of sal soda or washing powder and hot water. Rinse with clear water and apply the plastic paint without sizing.

Calcimined surfaces must be washed clean, so that no color remains in the corners around the trim, after which directions for covering wallboard or plastered surfaces may be followed. If the under surface has a high gloss from previous sizing, treat as suggested for gloss-paint surfaces, and apply the textone without using any sizing.

Spanish-Palm Finish, Made by Means of the Back of an Ordinary Kitchen Spoon

Wherever possible, wallpaper should be removed and the under surface treated according to whether it is of plaster or wallboard. If the paper cannot be removed, it must be securely bonded to the surface. Remove any loose parts or paste them down. Wallpaper that has been applied with paste that will soften in 8 or 10 hours must be removed. Wallpaper that contains water-soluble dyes will discolor the material and must be removed. A damp cloth rubbed over the surface of the paper will be discolored by such dyes. Roughen a high-gloss wallpaper with sandpaper. Wipe free from dust and dirt and apply the plastic material directly.

On glass, metal or wood, remove the grease and wax finishes and kill the varnish or glossy surface by an application of a 10-per-cent solution of sal soda or washing powder in hot water. Rinse with clear water. These surfaces should not be sized.

To apply the textone, use a clean wall brush, which is similar to a calcimine brush, and lay on a coat to a uniform thickness of 1/16 or 1/8 in. After it has set a little, until tacky or drawn up, stipple with a wall stippling brush, as in Fig. 6. Other effects can be obtained by the use of an ordinary paintbrush, Fig. 3, either slapping, pushing or dabbling it with a straight or side motion. A sponge or ball of crumpled paper, used as in Fig. 2, will vary the texture. Two persons work to the best advantage over large surfaces, one applying the material as the other does the stippling.

As hardened plastic paint of this kind is insoluble in water, do not allow it to spatter or harden on woodwork or trim. Wash them off at once with warm water and a sponge. Where the trim is in place, it is best to go over it with a rag moistened in boiled oil or kerosene, to make removal of spatters easy. Pails, tools and brushes should be kept clean. Do not let the material harden on them.

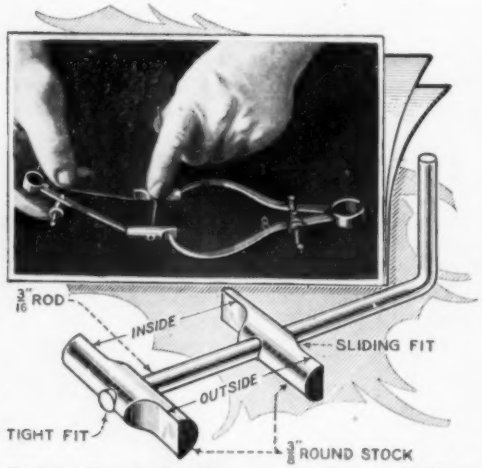
A moderate temperature should prevail in the room. While applying the paint, close the doors and windows to avoid drafts, opening them after application to permit a free circulation of air. Build a fire in cold weather.

When the coating has dried, place a piece of sandpaper flat on the surface and rub slightly. This enhances the texture by removing the rough or pointed edges and making it stand out more prominently. Plaster-molding effects are obtained by the simple process of covering ordinary wooden moldings with the textone.

The illustrations show a number of methods of finishing the material, and these are as follows: Fig. 1, Mission fin-

ish; the material is applied with a calcimine brush, and the texture obtained with a small brush worked over the textone with a circular motion. Use the palm of the hand to obtain smoothness where desired. Fig. 2, paper-stipple finish; the texture is obtained with a ball of wadded paper. The effect is a little coarser than if a stippling brush is used. Fig. 3, French finish; texture obtained by firm downward sweeps of a small whisk-broom; sandpapering the surface, when dry, will soften the effect somewhat. Fig. 4, scroll finish; the material is worked with the tips of the fingers in a circular motion. If the effect is too coarse, smoothing with the palm of the hand, or sanding when dry, will soften it. Fig. 5, English finish; the texture is obtained with a wide scraping knife or piece of tin, to imitate the effect of old tool markings. Fig. 6, stipple finish; material stippled with regular painters' stipple brush. This finish can advantageously be sanded when dry. Fig. 7, brush finish; the material is here applied with a wall brush, then stippled lightly with a wad of crumpled paper and finally brushed down with a large calcimine brush. Fig. 8, Spanish-palm finish; textone applied with a wall brush; texture obtained with the back of an ordinary kitchen spoon. The palm of the hand can be used to soften the effect, rubbing it over the marks made by the spoon, and this is suggested. Unless otherwise specified for these effects, the material is first applied with a large calcimine brush.

The effects obtainable are limited only by the ingenuity of the worker, and with the foregoing instructions he can easily work out new effects.



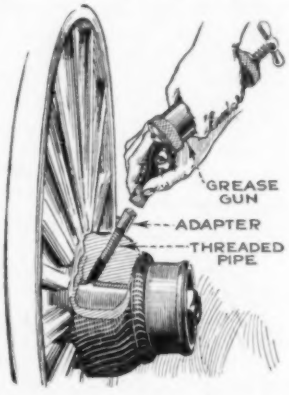
Tool for Transferring Measurements from an Inside to an Outside Caliper, and Vice Versa

Caliper-Setting Tool

It takes considerable skill to transfer sizes from an outside caliper to an inside caliper, and vice versa, owing to the small point of contact between the two tools. However, as it is a simple matter to set calipers against a flat face, the tool shown in the illustration is most useful for this work. Two pieces of 3/8-in. round stock are cut down to half their thickness on opposite sides, and carefully drilled and reamed in the center to fit a length of 3/16-in. rod bent to a right angle at one end. One of the pieces is a sliding fit and the other a tight fit on the end of the rod. Supposing a hole is to be drilled to fit a shaft; the outside caliper is first set to the shaft, then the setting tool is used to duplicate this measurement, as shown, and the inside caliper may be accurately set against the flats at the opposite ends of the cut-down pieces. This operation is, of course, reversed when setting outside calipers to an inside setting.

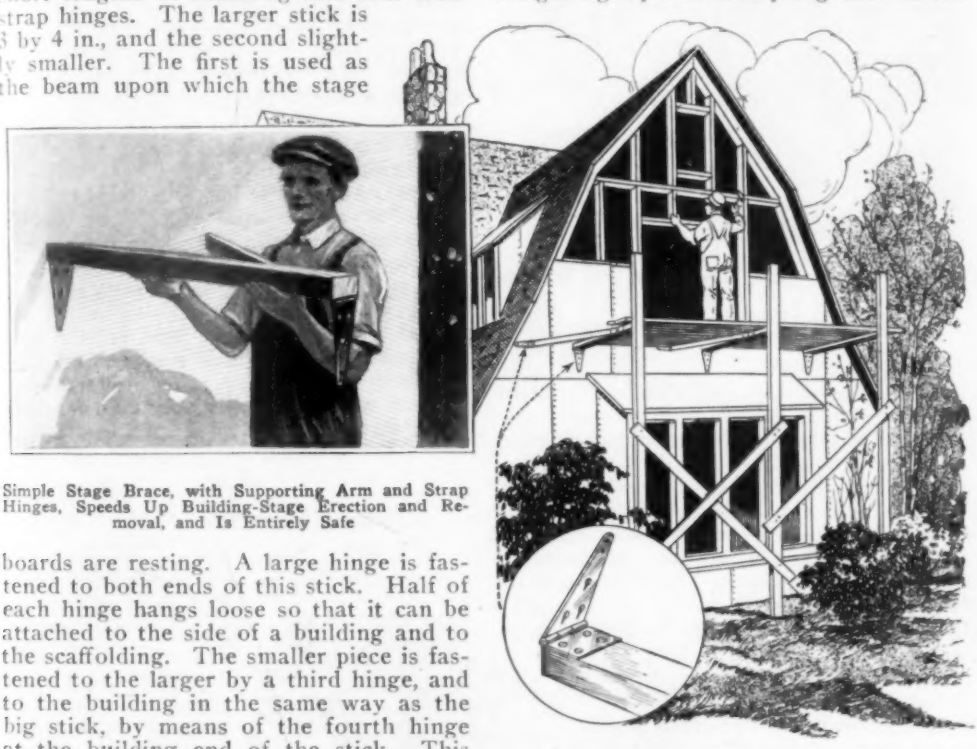
Lubricating Wagon Wheels

It is a rather disagreeable task to lubricate wagon wheels as the wagon must first be jacked up and the nuts on the axles must be removed. While performing this I have often wondered why wagons were not equipped with modern time and labor-saving lubricating devices, so I set about to adapt the wagon wheels to the grease gun. Adapters of the kind used on auto-spring bolts were obtained from a junk dealer. Four short lengths of pipe were tapped to take the adapters and a hole was drilled in each hub so that the lengths of pipe could be driven in snugly. The adapters were then screwed down into the tapped ends, as shown in the drawing, and it was then a simple matter to use a grease gun.—C. M. Wilcox, Torrington, Conn.



Rapid Stage-Erecting Device

A simple, effective and safe device for rapidly putting up stagings in the erection of buildings has been worked out by a Maine carpenter. It consists of two short lengths of scantling and four iron strap hinges. The larger stick is 3 by 4 in., and the second slightly smaller. The first is used as the beam upon which the stage boards are resting. A large hinge is fastened to both ends of this stick. Half of each hinge hangs loose so that it can be attached to the side of a building and to the scaffolding. The smaller piece is fastened to the larger by a third hinge, and to the building in the same way as the big stick, by means of the fourth hinge at the building end of the stick. This forms a supporting brace for the scaffold. Three nails are driven into the wall, and a like number into the scaffolding, allowing the holes in the hinges to pass over the heads of the nails. Then, as the weight of the sill rests on the hinge, it is pushed down and the nail heads act as buttons, fastening the hinges securely to the building and scaffold. The side brace fastens in the same way. To release it, simply raise and let the nail head go through the large end of the hinge hole.—Sam E. Conner, Auburn, Me.



Simple Stage Brace, with Supporting Arm and Strap Hinges, Speeds Up Building-Stage Erection and Removal, and Is Entirely Safe

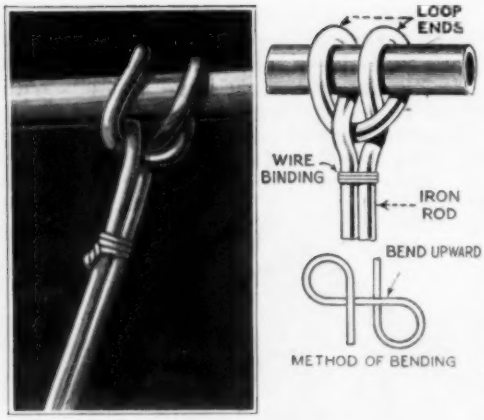
Connecting Pipes with a "Dutchman"

An excellent "dutchman" can be made, for straight work on large flanged-pipe lines that fail to meet and are too close to allow the use of a nipple. If flanges are not immediately available for making up the nipple, take a piece of the next size larger pipe. Face the ends off in a lathe, making the length of the dutchman the same as the distance between the two flanges that will not meet. Cut two gaskets from 1/16-in. sheet packing and force the lines apart so that the dutchman, with a piece of packing on each end, can be squeezed into the opening. Pull the two flanges tightly and evenly together all the way around, using long bolts. This makes a very satisfactory job for medium steam and water pressures.

Removing Lead from Automatic Pencil

It is a rather laborious job to drill the lead out of a steel pencil when it becomes lodged in the point, as drills small enough are not always at hand and there is also danger of injuring the tiny lugs that hold the lead. The simplest way is to hold the point of the pencil in an alcohol flame for a few seconds while exerting pressure on the lead by turning the feed. The lugs will be expanded so that the lead can easily be forced out. Care should be taken not to hold the pencil in the flame too long, as heating it too much may injure the point.—L. A. Krider, Hatton, Wash.

¶Wallpaper can be washed with a soft cloth saturated with benzine; neither pattern nor color will be affected.



Handy Tool for Pulling Lengths of Pipe from the Stock Rack

Removing Pipe from Racks

The photo shows a handy tool used in a pipe warehouse for pulling out lengths of pipe from racks too high to reach easily with the hand. No machine work is necessary to make the tool, the work being a simple bending operation. A length of iron rod, about ⅜-in. in diameter, is bent round to form two loops in the center, with the ends of the rod pointing in opposite directions. An upward bend is given the loops to bring them in line as shown, after which the ends of the rod are bound in three places with wire, near the loops, in the middle and again near the end. The finished length of the tool is about 4 ft. To pull a piece of pipe from a rack, the loops are passed over it and the handle pulled. This binds the loops on the pipe and the latter is pulled out. If the pipe is short, it can be lowered bodily to the floor. Long pieces are pulled out of the rack until overbalanced and then let down easily to the floor.

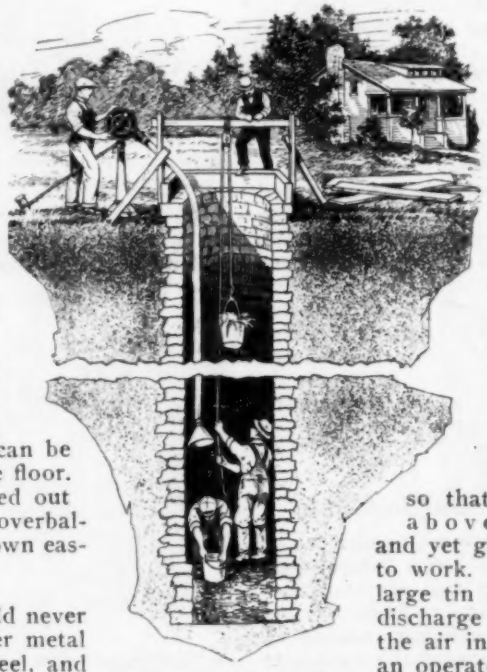
¶Rose reamers should never be used for any other metal than free-working steel, and then only under the best working conditions.

Starting a Stiff Engine

After tightening up the connecting rods of an engine, or possibly the crankshaft bearings, it often occurs that the engine cannot be turned with the starter. This condition may be discouraging, but if the owner of the car has an extra battery or can borrow one temporarily, it will be possible to turn over even a very stubborn engine. To use the extra battery, connect one side to the ground and the other side to the terminal of the starting motor, duplicating the connections as made with the regular battery in the car; in other words, connect the batteries in parallel so that the voltage will be the same but the amperage doubled. The extra battery can be placed on the running board of the car, and temporary connections made to the ground and to the starting-motor terminal. This method is used regularly by a mechanic of a small service and sales station. Also under other adverse conditions, as during extremely cold weather, with tight pistons, or a gummed motor, the method will prove helpful.

Ridding Deep Well of Foul Air

A resident found it necessary to clean out an old, deep well. Upon investigation the air at the bottom was found to be foul and unfit to breathe. Just how to get rid of this air was the problem until a neighbor suggested rigging up a blacksmiths' forge blower in the manner shown. The blower was set up alongside the well curb and secured with a guy rope and stake, as indicated. A piece of fire hose was clamped around the nozzle and dropped to within a few feet of the bottom of the well, so that it would hang just above the worker's head and yet give him enough room to work. The flaring end of a large tin funnel was used as a discharge nozzle to distribute the air in all directions. With an operator turning the blower crank slowly, the cleaner went to the bottom of the well and



Forge Blower Used for Supplying Air to Workers in Deep Well

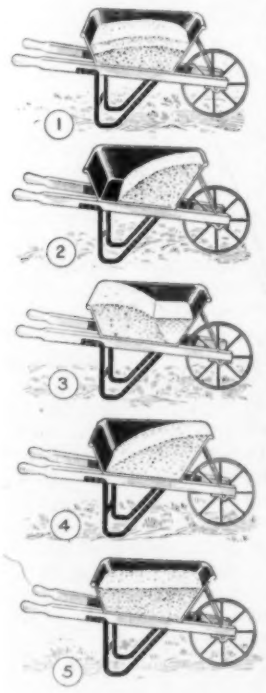
there was no difficulty in supplying him with plenty of fresh air.—L. B. Robbins, Harwich, Mass.

Substitute for Draw-Filing

Draw-filing of cast-iron cylinders, which is a tedious job and produces uncertain results, can be done better by the use of knurling tools. The wheels, costing from 15 cents up, can be obtained for all sorts of fancy finishes. They give a uniform finish, and take only half the time required for draw-filing. This method can also be used on cylinders for finishing presses and similar classes of textile machinery.—H. M. Toombs, Chicago, Ill.

Mixing Concrete in the Wheelbarrow

A simple and easy method of mixing concrete by hand in a wheelbarrow is shown in the illustration. Fig. 1 shows a batch of dry material consisting of four shovelfuls of gravel, two of sand and one of cement. Fig. 2 shows the first operation, working the material to the front of the barrow, with a round-pointed shovel. Fig. 3 shows the same batch after it has been worked back again in the same way and some water has been added. The material is worked to the front again, leaving it in the position shown in Fig. 4, and then again backward. It is now thoroughly mixed and will keep itself in the position shown in Fig. 5. The writer has used this method and found it entirely satisfactory.—H. H. Siegele, Emporia, Kans.



¶To prevent exposed black pipe from rusting, cover it with a grease made of 1 lb. lard, 1 oz. gum camphor and 1 oz. black lead.

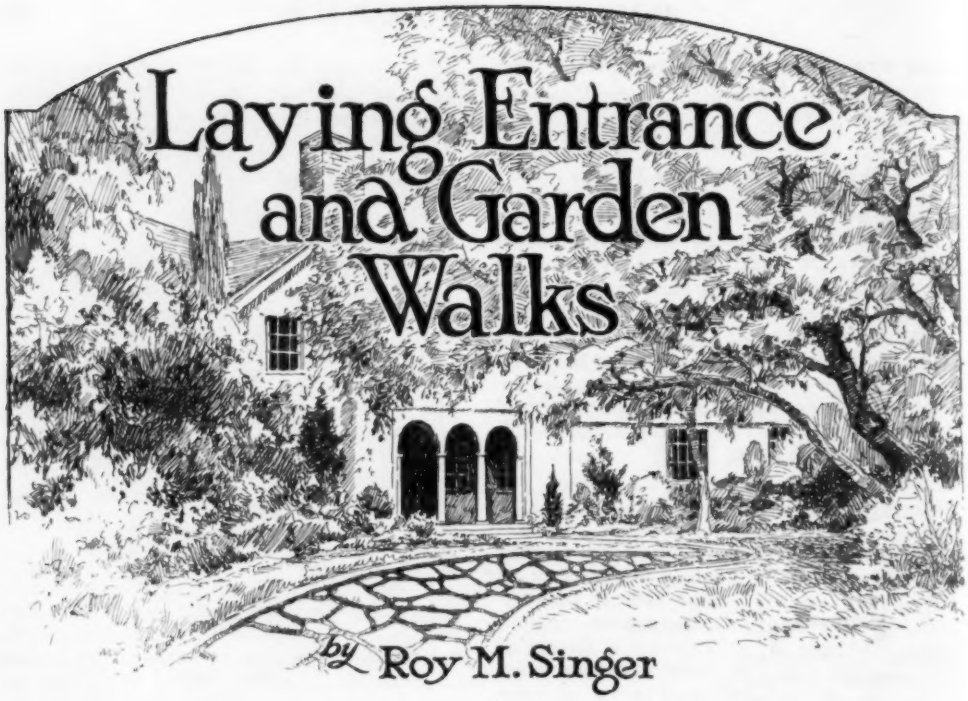
Neat Wooden Boxes along the Roadside Hold Farmers' Cream Cans

Boxes for Cream Cans

Instead of following the usual custom of dropping the cans at the roadside to be jostled or stolen, one Texas creamery has had several hundred wooden boxes built and placed along the road. The boxes hold three 5-gal. cream cans, and when the truck drivers return the empty cans, they place them in the box and close the lid. The system has practically stopped complaints and theft, and is a method endorsed by the road commissioners. Each box is 18 in. wide, 40 in. long and high enough to take the cans. The cover is hinged and the outside bears this message, "Leave Cream Cans Here."

Keeping Moss from Choking Irrigation Canals

The aquatic moss which grows in the smaller lateral irrigation canals during the summer months, sometimes to such an extent as to interfere seriously with the delivery of irrigation water, can be kept down by dragging a heavy iron chain along the bottom of the canal. Two two-horse teams are used. One team is attached to each end of the chain and the two teams are driven along the banks, one on either side. The dragging is done about three times a week during the entire irrigation season. The work can be done whenever convenient, without shutting the water out of the canal.



Laying Entrance and Garden Walks

by Roy M. Singer

ONE of the main features of a home is the walk leading to the entrance door. It is the first thing that meets the eye of the person entering. If the walk is neat and well kept, the impression is bound to be fair; if it is poorly laid and ill maintained, the impression is likely to be a bad one, notwithstanding the fact that the exterior of the house may be beautiful. Not alone the front but also the side walks and the garden walks, if laid in an attractive manner, will go far toward making the house good to look at.

It must be said at the beginning that the main purpose in writing this article is to show how to construct a well-built walk other than the ordinary concrete sidewalk, and to illustrate various patterns and different materials which may be used to good advantage.

The materials for the construction of a decorative walk depend a good deal upon the location of the town in which the walk is to be built. For example: in certain towns slate is available, in others it is not; in some brick may be purchased at a very reasonable figure, in others it will be found to be quite expensive. Thus, where cost is an important factor—and it generally is—the material should be selected from among those most readily available in the town.

There are four materials which lend themselves to decorative-walk construction, and they are stone, brick, tile and concrete. With stone, some very attractive walks of the flag-type may be built. Flag walks are of a rather informal appearance when laid with wide joints so that the grass grows between the stones, and are more suitable for gardens than for the front walks to homes, but where a rustic effect is desired, such as the walk for an English-cottage-type house, set in rather heavy foliage, nothing blends into the picture so well as a flag walk with the flags about an inch apart and grass growing between them.

Brick and tile present a more formal or citylike appearance than stone, although brick may be laid with wide grass-grown joints to give a garden-walk effect. It is more often, however, laid in a simple pattern and the joints filled with cement grout. Ordinarily the joints in brick walks are not greater than 3/16 or 1/4 in., although when a grass-grown brick walk is desired the joints should be at least 3/8-in. wide but not more than 5/8 inch.

Tile used for walks is of the kind known to the trade as quarry tile. It is not quarried, however, as its name might indicate, but is made of burnt clay in the same manner as brick. It comes in sizes ranging ordinarily from 4 by 4 to 8 by 8 in. It may sometimes be had in larger sizes than 8-in. squares, but seldom smaller than 4 by 4-in. The thickness may vary from 1/4 to 1 in. depending upon local kiln practice.

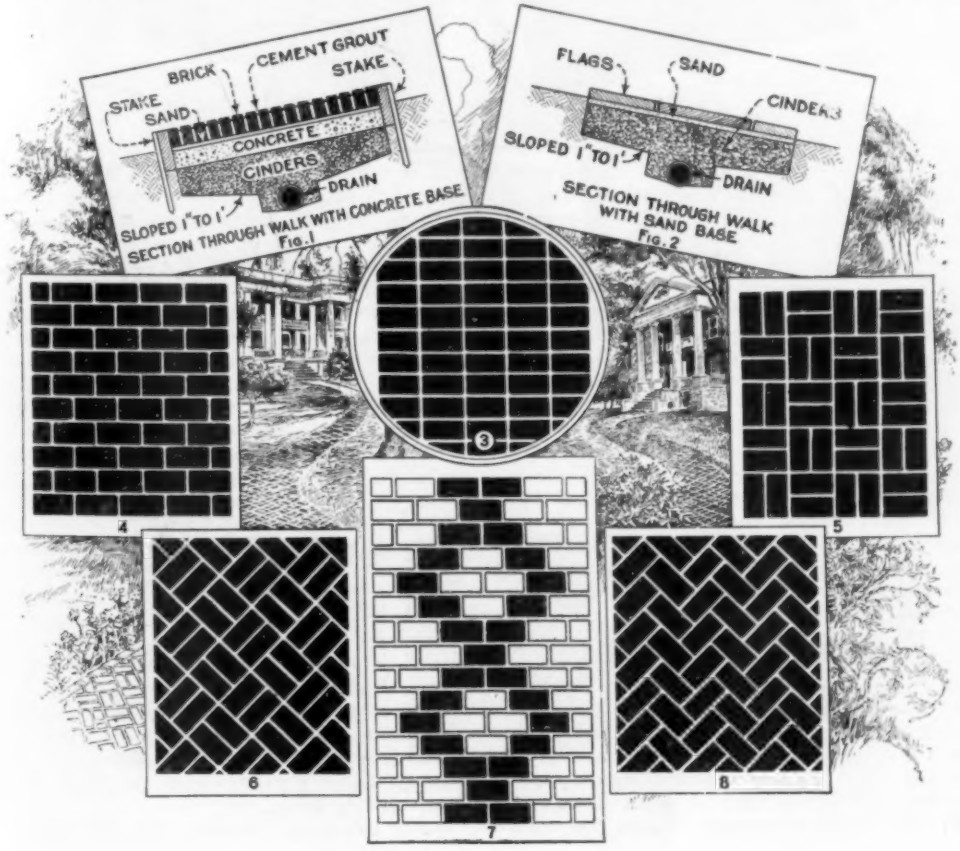
Concrete is a good material for orna-

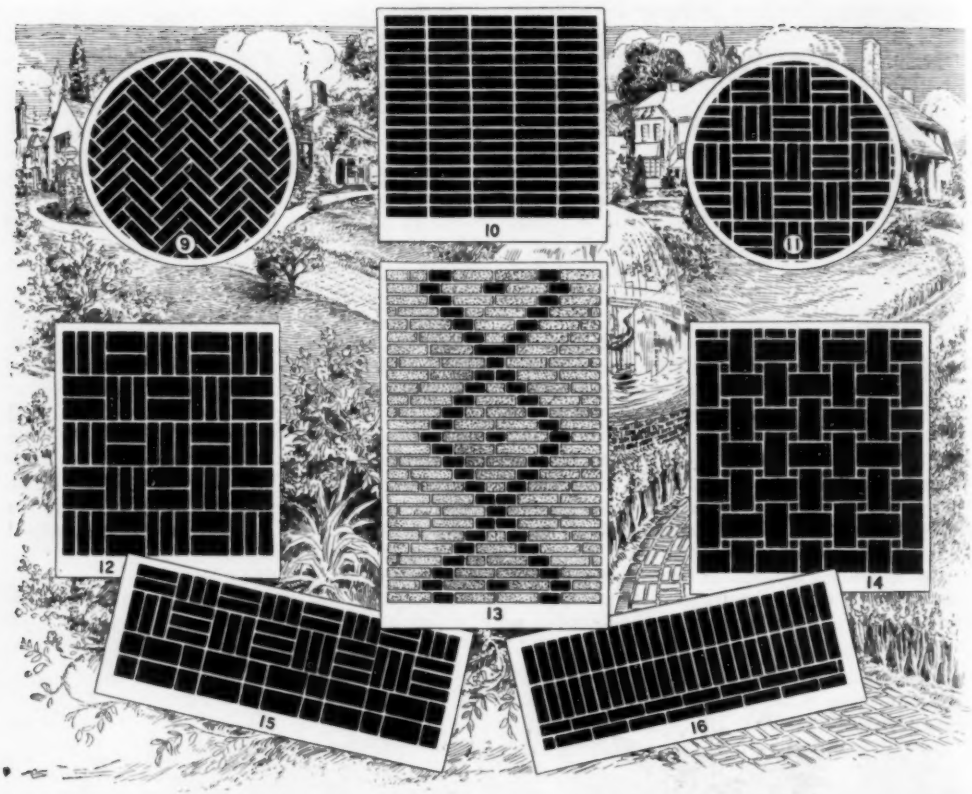
mental walks in that it may be used to make concrete flags or tile, and thus this material may be used in localities where the genuine is not available. One advantage of concrete is the fact that it can be had everywhere. With concrete flags a very attractive effect may be obtained by coloring the pieces. All that is necessary is to add some mortar color to the mixture when it is made up. A varicolored walk may be built up by using units of several tints. This makes a very attractive walk provided the colors are subdued and blended harmoniously.

We will first take up the construction of a walk, of which there are two main types, that with a concrete base, and that without. Where climatic changes are considerable no walk should be built without a concrete base, lest it be destroyed by being uplifted due to the action of frost; but in warm climates, where heavy frosts are not encountered, the concrete base may be dispensed with.

Fig. 1 shows a section through a brick walk with a concrete base. Brick walks, by the way, should always be built with a concrete base. Some change in the surface due to settlement is bound to occur in time if they are not. The first step in the construction of a walk is to excavate the top soil to a depth of about 10 in. so that a firm base for the walk may be obtained. The surface should then be thoroughly tamped to make it solid. In the center of the walk a line of drain tile should be placed, if the ground is low and the drainage poor. In high ground, where the natural drainage is good and the soil fairly sandy, the drain need not be installed but it must be used where natural drainage is poor and the soil is clayey. It is better to fill the pocket in which the drain tile is set with gravel than with cinders, as is sometimes done, for the gravel will let the water seep through to the drain tile easier than will the cinders. Notice in the sketch that the bottom of the excavation is sloped toward the pit in which the drain is laid. This slope should be about ¼ or 1 in. per foot.

After the drain is installed, the excavation should be filled to a depth of 6 or 8 in. with cinders, well wetted down and





tamped firmly and solidly. Next the concrete base is applied between the forms, as shown in the sketch. The forms consist of 2 by 4-in. lengths held in place by stakes. The stakes are made high enough so that an additional 2 by 4-in. piece may be attached and used as a guide for laying the brick. The concrete used should be a 1:3:5 mix, and should be allowed to set for 24 hours before the brick are laid upon it.

Before beginning to lay the brick, a thin layer of fine bank sand, about ⅛ to ¼ in. thick, should be spread on the concrete. This sand cushion will take up all the little unevenesses in the surface of the concrete and make the laying of the brick easier, in addition to providing a cushion for the walk. The brick are laid to the desired pattern on the cushion of sand, and the joints are then filled with grout. This grout is made by mixing one part of Portland cement with one part of fine bank sand and adding enough water to make the mixture flow easily. In filling the joints take care that any grout lying on the edge of the brick is quickly removed with a wet rag, for after it sets, it will be difficult to scrape off and the walk will not look well. At intervals of about 18 or 20 ft., the joints should be filled with tar or asphaltum in order to provide an expansion joint. Another way of grouting a walk would be to fill the joints with a dry mixture of cement and sand, and then sprinkle it with water. The first method is to be preferred, however, for, though it requires a bit more care to pour the grout than to pour the dry mixture in the joints, the effort is well repaid by the assurance that the entire joint is filled with concrete instead of the possibility of having the top half filled with concrete and the bottom half with a dry powder.

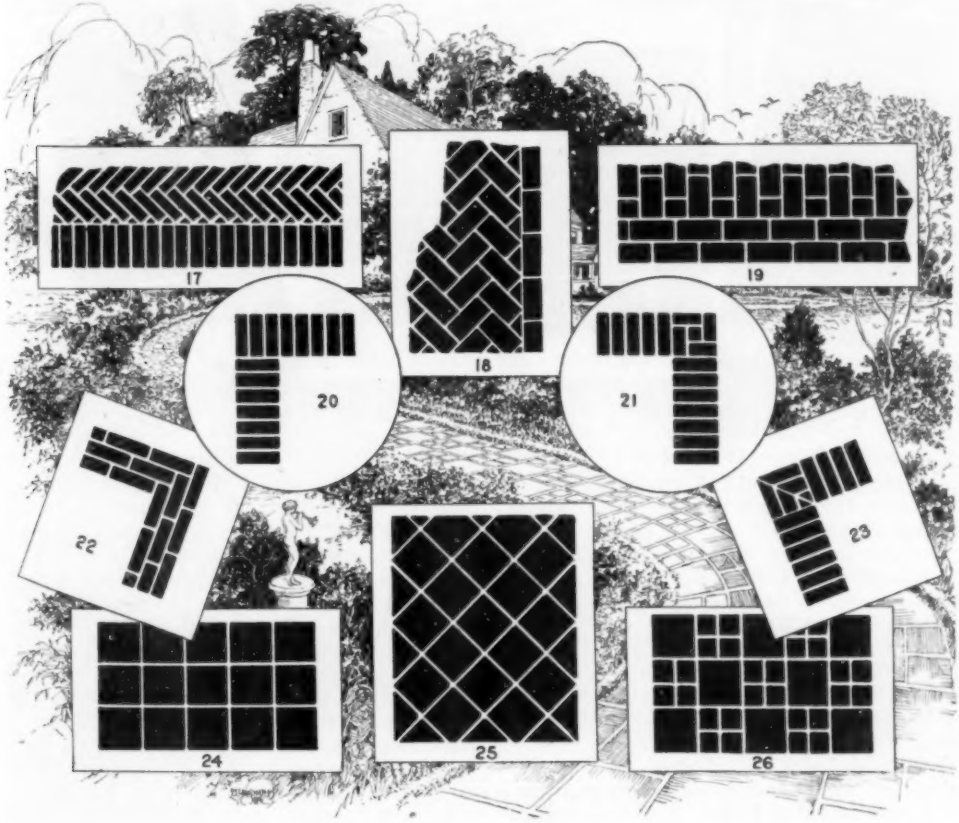
Where walks are laid without a concrete base, the construction is shown in Fig. 2. This is practically the same as for the construction with the concrete-base walk except that the concrete is omitted and the sand cushion laid directly upon the cinders. The sand cushion should be made ½ to 1 in. thick. Walks with only a cinder base are not grouted, but are intended for use where it is desired to allow grass to grow between the joints in the walk.

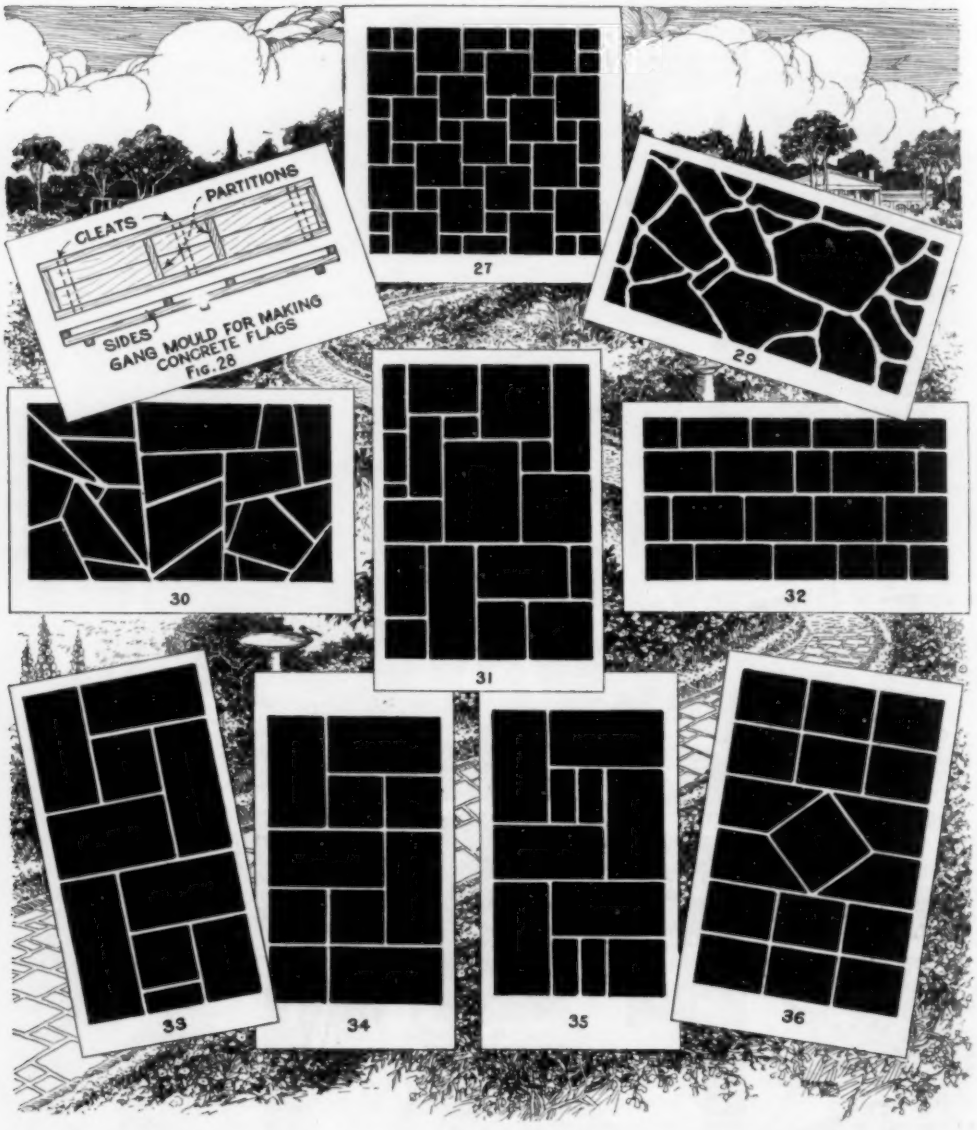
Many beautiful patterns may be laid in

brick walks. Brick lends itself especially to pattern work due to the proportions of the units, the ordinary building and paving brick being about 2 in. thick, 4 in. wide, and 8 in. long. Thus, allowing for a mortar joint of suitable width, two thicknesses of brick make one width and three thicknesses make one length. Thus, various arrangements of width, thickness and length may be made. There are two ways of laying brick walks; the first with the brick flat, and the second with the brick laid on edge. Laying the brick flat, fewer brick are required for a given area than setting the brick on edge, but the laying will be found slightly harder. Flat-laid brick adapts itself better to wide, grass-filled joints than does brick laid on edge. It may be taken as a commonly accepted rule that brick laid on edge should always be laid on a concrete base, and the joints filled with cement grout. Brick laid flat, however, need not be laid on a cement base and need not have the joints grouted. A good width for the ordinary front walk is about five bricks wide, or approximately 42 in. A four-brick-wide walk (about 33 in.) may also be used if the first width is too great. Garden paths and winding lanes through shrubbery may be made three bricks wide.

In Fig. 3 is shown the southern style of walk. This consists of brick laid flat in a regular pattern. In Fig. 4 is shown a variation of the southern style, which calls for the breaking of the joints in each row. The brick could also be laid with the length of the brick parallel to the length of the walk, instead of perpendicular to it as illustrated.

Fig. 5 illustrates the hearth pattern. Here two bricks are laid parallel, with alternate pairs at right angles. A variation of the hearth pattern is shown in Fig. 6. This consists of laying the brick at an angle of 45° with the border of the walk instead of parallel to it. In this, the brick at the edge of the walk must be cut in order that the line at the edge of the walk be preserved. Fig. 7 is the same pattern as Fig. 4, except that a diamond design is worked into it by the use of different-colored brick. In laying a walk in this pattern it is not well to have too great a contrast between the brick colors. If the two colors are just differ-





ent enough so that the diamond design is only slightly discernible, the best effect will be obtained.

The herringbone pattern shown in Fig. 8 is a neat one, and is quite popular. It is comparatively easy to lay and less cutting is required than for the design shown in Fig. 6. In Fig. 9 is shown the herringbone pattern with the brick laid on edge. Laid on a cement base, this pattern with the joints grouted, provides an especially strong and durable walk.

Edge-laid brick, illustrated in Fig. 10, makes an easily built and strong walk. The brick can also be laid with the joints broken, as shown for the flat-laid brick in Fig. 4. In Fig. 11 is illustrated the basket-weave pattern, somewhat similar to the hearth pattern shown in Fig. 5, except that the bricks are laid on edge, and that three bricks are used instead of only two. Fig. 12 is a combination of the basket-weave and the hearth pattern. Fig. 13 shows a diamond design worked into an edge-laid walk. A little study will show that this design differs considerably from the diamond design shown for a flat-laid walk in Fig. 7. A combination brick and tile walk is illustrated in Fig. 14.

In some cases, it is desirable to have

borders for the walks, not only for the added decorative effect, but because, with the pattern used, small pieces are left at the edge and a border is required to hold them in place and prevent their being chipped out. Thus, while the design shown in Fig. 14 would not require a border, that illustrated in Fig. 9, the herringbone walk with the brick laid on edge, would need a border in order to keep the small triangular filler pieces from being knocked off the edge. Figs. 15 to 19 illustrate borders of various designs which may be used. Figs. 21 to 23 show various ways of building up a corner in a brick walk.

Some patterns for quarry-tile walks are shown also. Fig. 24 illustrates a walk with the joints laid regular. A variation of Fig. 24 would be to break joints similar to the manner used in the flat-laid brick walk shown in Fig. 4. Fig. 25 shows a walk with the tile laid at an angle of 45° with the edge of the walk. This is a pleasing design but the cutting of the tile for the edges is quite a task, and a good many will be wasted due to their failing to cut properly. In Fig. 26, two different sizes of tile are used, as is also the case in the pattern shown in Fig. 27. As a great many sizes and colors are obtainable in this material, some very beautiful patterns and color schemes may be worked out. It should be borne in mind, however, that of the several types of walk described in this article, those built of quarry tile are the least durable, and are more suited to interiors and semi-protected places than to open spaces where they may be subjected to the continuous action of the elements.

Perhaps the most decorative walk of all is that made of flags. Flags are large stones about 10 by 24 in., or thereabout, although they may run in size from 6 by 8 to 12 by 36 in. They may be laid on a cinder-and-sand base without fear of great distortion, and they appear particularly attractive when they are laid about 1 in. apart with grass between the joints. In some localities stones of different colors are obtainable and they may be used to advantage in laying a walk in a desirable color scheme. A combination of reds and browns, or greens and blues, or any other colors which do not clash, is very pleasing.

Where stone is not readily obtainable, concrete flags may be made. A gang mold for making concrete flags is shown in Fig. 28. Here three flags can be made at a time, two large and one small, although the number, size and shape may be varied to suit the requirements of the job. The mold consists of two planks fastened together with cleats to form the bottom, and enough cleating nailed around the edges to give the desired shape and size. The flags are molded in the same manner as any other kind of concrete casting. They should be about 3 in. thick, and it is well to reinforce them with chicken wire, especially the larger sizes. When applying the wearing surface, color effects may be obtained if a little mortar color is added.

Fig. 29 shows a walk built of field stone; this is, as its name implies, a walk built of stones of random sizes and shapes, fitted together in a kind of crazyquilt pattern. The stones are laid with rough edges, just as they are picked up in the field. This is an ideal rustic walk for heavily wooded places. Fig. 30 is a similar walk with the edges cut to a line. The walk shown in Fig. 31 is what is known as random rectangular, that is, the stones are rectangular in shape but of random sizes, and are fitted together as shown in the pattern. A variation of the random-rectangular pattern is shown in Fig. 32. Here the stones are of one width in the respective rows, but of varying lengths. Figs. 33 and 34 show designs obtainable by the use of flags of two different sizes, and in Fig. 35 is illustrated a walk involving the use of three different sizes. Fig. 36 is a diamond pattern which may be worked into a flag walk somewhere along its length or at a crossing.

There are an infinite number of patterns for the different materials mentioned in this article. Anyone with just a little ingenuity can develop a host of patterns, using those illustrated as a basis upon which to work.

© Keystone View Co.

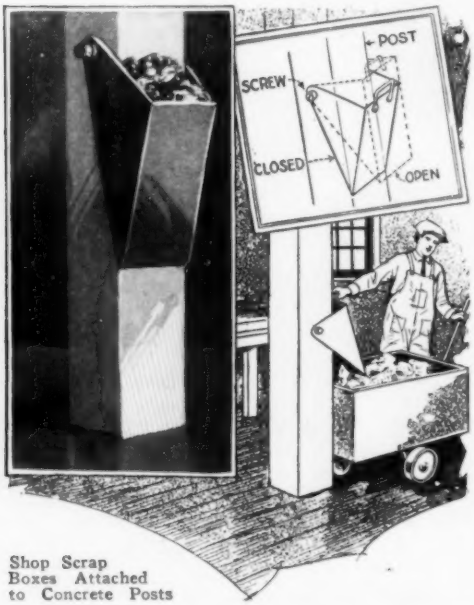
Rock Drill Run by Automobile Engine, Which Is Mounted on Truck

Auto Engine Runs Rock Drill

One might mistake the vehicle shown in the photo for a two-way automobile, but it happens to be an ordinary truck with an extra engine mounted on the rear. This is used for the purpose of running a rock drill, which is geared to it.

Handy Shop Scrap Box

To keep the floors and benches of the shop clean, a large concern is using scrap



Shop Scrap Boxes Attached to Concrete Posts

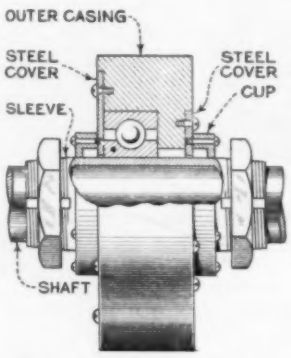
boxes attached to the concrete pillars on each floor. Loose boxes were formerly placed at intervals around the shop, to be emptied at the end of each day, but very often they would be moved to suit some person's convenience, with the result that the man detailed to empty them would have difficulty in locating them. The shape of these boxes is clearly indicated; they are constructed of sheet metal and are held to the posts by means of a screw and washer on each side, the screws being turned into wood plugs driven into the concrete. The truck used to carry away the scrap is backed up to touch the post under the box, and the latter is then lifted by the handle in order to allow the contents to drop into the truck.

Testing Galvanized-Iron Wire

Many farmers send for samples of wire fencing before placing an order. Often two samples arrive that appear to be the same-gauge wire and, as far as looks go, galvanized alike. Usually the farmer rushes his order off to the manufacturer quoting the lower figure. This, however, might not happen if he realized that the life of the fencing depends on the thickness of the protective coating of zinc, and tested the samples in this respect. Such a test may be made in the following way: Leave a sample of the wire in a saturated solution of sulphate of copper for one minute. After wiping it clean, replace it in the solution for another minute. Repeat this process four times, and if the wire keeps its black color, it is proof that the zinc has not been eaten away and that the galvanizing has been well done. However, should the wire appear copper-colored after the second or third immersion, the coating is too thin to make the wire economical for fencing purposes. Most farmers have sulphate of copper, or blue vitriol, about the farm, as it is used widely in spraying solutions. A saturated solution is made by dissolving as much of the crystals in water as the latter will take up.—C. M. Wilcox, Torrington, Conn.

Ball-Bearing Adapter

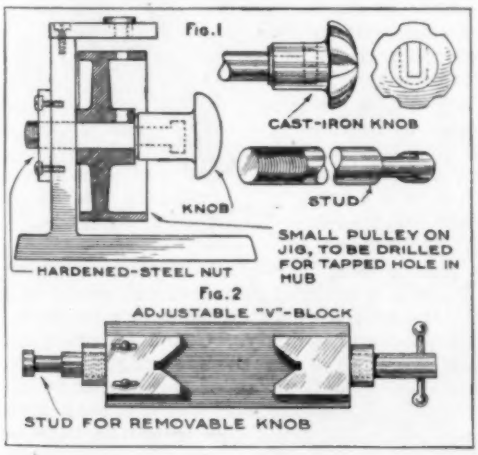
Bearings from old automobiles, tractors, etc., can be used to advantage for line-shafts and countershafts on various sorts of machinery. To mount the bearing on the shaft, a sleeve is made from steel tubing of the proper size, which requires the least labor to machine. The sleeve should be a close sliding fit on the shaft and a press fit in inner race; the bearing is made to project from the bearing race approximately 1½ in. on each side, is turned slightly tapering at each end, and threaded and slotted into three or four sections in the tapered parts. Two nuts are provided to fit the tapered ends and, when tightened, will clamp the bearing sleeve firmly to the shaft. The outside casing for the bearing is made from a piece of cast-iron bushing stock, which may be obtained from an iron foundry. The casing is machined as shown, being made a light press fit for the outside of the ball-bearing assembly. Recessed sections are provided at each end of the casing in which are fitted the steel covers, made of ⅛-in. mild steel, these covers being held in position by machine screws. To exclude dirt and retain grease,



two cup-shaped pieces, made of cast iron, are attached with machine screws. Care should be taken to select ball-bearing assemblies that are in first-class condition, to assure their satisfactory service. The outside casing is provided at two opposite points with small depressions to receive the points of the handscrews, and a compression grease cup should be fitted to supply the necessary lubricant.—Edwin Kilburn, Spring Valley, Minn.

Detachable Knob for Jigs and Fixtures

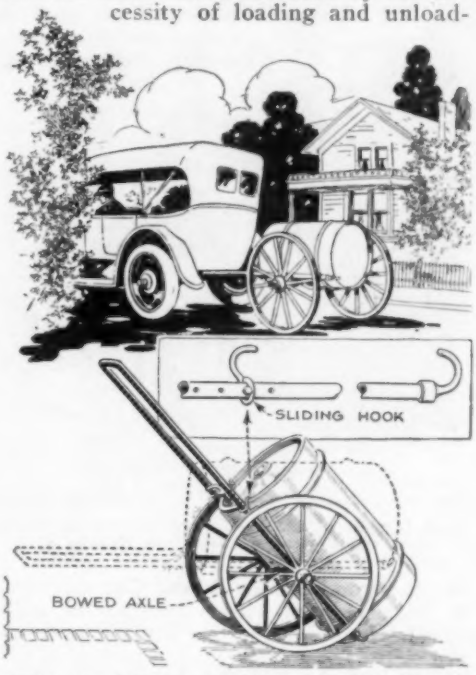
Many times the jig, fixture and tool designer is confronted with the need for a detachable knob or nut, not only for the purpose of removal so that the work or another piece can be taken from the stud, but also as a method of setting an adjustment that can be kept free from tampering. The drawing shows a nut of this type that has been used with satisfactory results. The fixture stud is machined with flats on opposite sides and the knob, which can either be cast or machined, has a slot in the side so that it will fit over the stud. Fig. 1 shows the construction of such a knob and its use in a fixture that holds a small pulley while drilling an oil hole. The stud is threaded and screwed into a hardened-steel nut at the back of the jig. By removing the slotted knob the work can be slid on the stud and the knob then replaced and the screw tightened. Fig. 2 shows its use on an adjustable V-block fixture. The object in having the knob removable in this case is to prevent alteration of the adjustment as set in the tool room.—W. Burr Bennett, Honesdale, Pa.



Detachable Knob Facilitates Handling of Tools, Jigs and Fixtures

Trailer for Gasoline and Oil Drums

In moving from place to place, contractors are often inconvenienced by the necessity of loading and unloading gasoline or oil drums onto and off trucks. This difficulty can readily be overcome by providing a trailer like that in the drawing, which was made for the purpose. It consists of a bowed axle conforming to the curvature of the drums, and a frame made of pipe. In use, the frame is held in a vertical position against the drum, and the hooks on the frame are engaged with the end edges of the drum. The trailer is then leveled and attached to the truck.—G. E. Hendrickson, Argyle, Wisconsin.



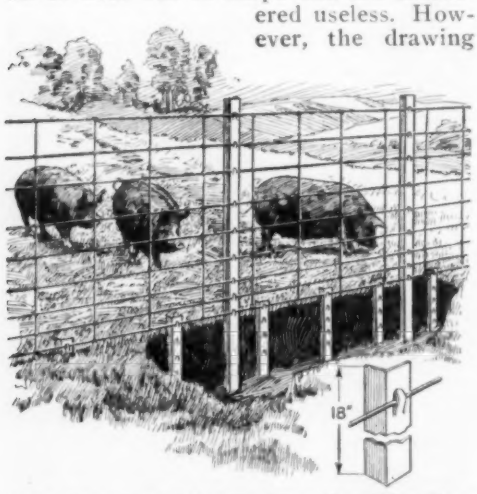
Trailer for Gasoline and Oil Drums That Will Be Found Useful to Contractors

Keeping Canal Banks Free of Grass

One irrigation district, where Johnson grass along the canal banks grows down to the edges of the water and causes sand and debris to accumulate and seriously retard the flow, has found that the grass can be kept down economically by pasturing herds of sheep and goats along the banks. The animals are confined by portable fences, which can be moved along the banks as fast as the grass is eaten off. Several other methods tried were either unsuccessful or too expensive.—Ivan E. Houk, Denver, Colo.

Using Broken Steel Fence Posts

Wherever steel fence posts have been in use you will find some have been broken off or bent out of shape and are considered useless. However, the drawing



Short Lengths of Old Steel Posts Keep Wire Fence Taut and Prevent Animals from Ruining It

shows a good use for them. Cut them into 18-in. lengths with a hacksaw or cold chisel. In this way you will get four or five pieces from each post, according to its length and condition. The pieces either have holes in them or a hook of some kind where wires have been fastened, except the part that has been in the ground. That part should have a small hole drilled through one end. With a sledge or maul drive one or two of these lengths between each of the line posts along the fence; fasten the bottom wire of the fence to one of the holes or hooks near the end of the post and drive it down until nearly all is in the ground. These posts will stay as long as the fence is there, and no hog can lift the fence and get under it, and it will also prevent cattle and horses from crowding the fence in trying to get what is on the other side.—J. R. Koontz, Bremen, Indiana.

Economy in Steam Heating

By running a steam-heating plant in the following way, much fuel can be saved at little expense. Repack all the steam valves with valve-stem packing. Get a ⅛-in. pipe plug for every radiator air valve. Repack the gauge glass, try all the cocks and see that everything is tight. Close all radiators, except one. Raise the steam, taking off the air valve on the radiator left open, and wait until the steam comes freely. Then, with a glove on or a rag wrapped around the hand, to prevent scalding by the escaping steam, insert a ⅛-in. plug, with a little paint applied to the threads, and screw it tight. Do the same with the other radiators. Also, if there are any air valves on the lines, take them off and plug the holes. Be sure the air is all out of the system. Do not try the petcock underneath the gauge glass, unless the gauge shows steam. The whole house will be heated without an ounce of steam showing on the gauge. As there is no air in the system, the radiators act as condensers and pull the steam toward them. The radiators of the plant where this experiment was made were all warm in the morning, and the boiler was shut down all night. It will be necessary to carry out the above preparations every season.—Alexander Gray, Chief Engineer, Colored Orphan Asylum, Riverdale-on-Hudson, N. Y.

Locating Reversed Field Coils

Occasionally the motor trouble shooter is required to locate a reversed field coil in a direct-current motor. The usual method of going about this is to employ a compass, which, if the field cannot be energized, is the only instrument that can be used for this purpose. Under some circumstances even this method is uncertain, depending largely upon the quality of the compass as well as on surrounding magnetic influences.

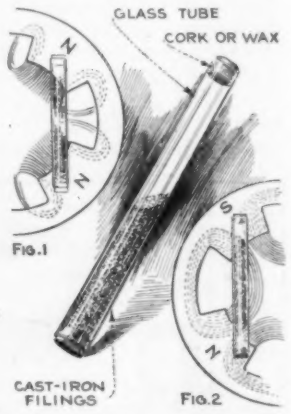


FIG. 1 FIG. 2

If the field circuit can be separately energized, a little device that will never fail to indicate a reversed field can be made cheaply and quickly. Cut a ½ or ⅝-in. water-gauge glass to a suitable length, according to the size of the motor to be tested. Plug one end with a cork and pour in cast-iron filings until the tube is half full. (Do not use steel filings as steel holds residual magnetism.) Then seal the other end. Tests can be made without removing the armature, but it is better if this can be done. Like poles repel

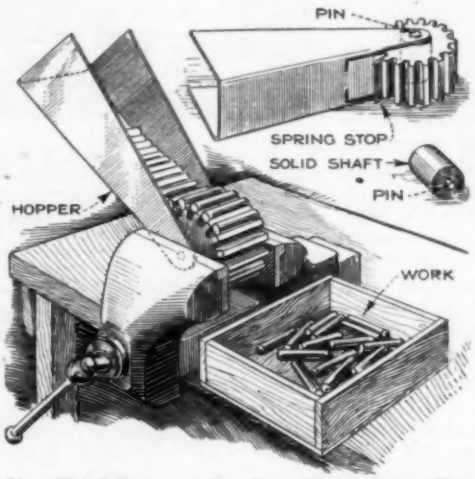
each other and unlike poles attract each other. This will be clearly indicated by the filings, which follow the form of the lines of force within the tube, when it is placed across any two poles. Figs. 1 and 2 of the drawing indicate respectively the action of the filings when placed in dissimilar and in similar magnetic fields.

Glazing Brick Walls

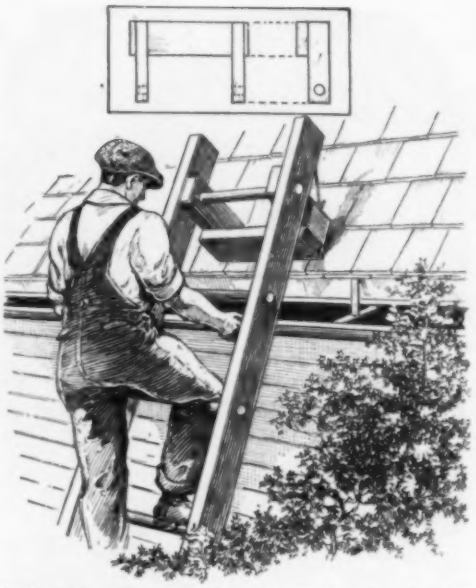
On brickwork in boilers, a rich brown glaze for the side walls and arch is very desirable. The addition of 12 per cent of sodium silicate to the ordinary mixture of fire clay and ganister for the bonding of the brick, and a final wash of sodium silicate and fire clay for the surfaces, help to produce a uniform glaze of this kind. It gives a surface which is impervious, prevents air leakage and helps to eliminate clinkers from becoming attached to the walls.—H. M. Toombs, Chicago, Ill.

Fixture Facilitates Pin Stamping

An unusual device to aid in stamping the part number on pins has recently been adopted by a concern manufacturing a popular article on which a large number of pins are used. The fixture is held in a bench vise when in use. The two main parts are a sheet-metal hopper and an old gear. The hopper is bent to the shape shown in the drawing and two slots are cut in it where it is turned over to form a spring or indexing finger. The gear turns on a solid shaft slightly longer than the gear width and all parts are held together by a pin passing loosely through the shaft and hopper ends, and riveted over on both sides. The spring stop piece just fits between the gear teeth to prevent the gear from turning while the top pin is being stamped. The operation is simple: A couple of handfuls of pins are laid straight in the hopper. After each pin is stamped the gear is indexed one tooth. The pins feed themselves on the gear and drop into a box on the other side after being stamped. —Harry Moore, Montreal, Can.



Sheet-Metal Hopper and a Gear Make Fixture That Facilitates Stamping Pins

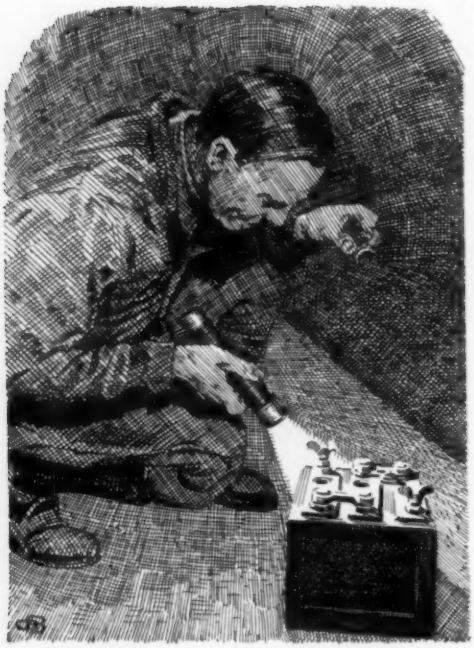


Safety Attachment on Extension Ladder for Hanging Up Eaves Troughs

Ladder Attachment Aids in Hanging Eaves Troughs

The usual method of attaching eaves troughs to overhanging cornices is to place the ladder against the side of the building under the cornice. This obliges the worker to stand on the ladder with nothing to steady himself while putting up the trough. The attachment shown in the drawing eliminates the danger of overbalancing, and has proved a time and money saver. It consists of three boards assembled as indicated and pivoted on the top rung of the ordinary extension ladder. In use, it is held at a right angle by means of a stout hook, so that the ladder clears the eaves trough, enabling the worker to stand steadily in a natural and safe posture, and to see what he is doing.

¶In tempering small dies, heat until a piece of wire solder will just melt when touched to the dies, and then quench.



Preventing Danger of Explosion of Hydrogen Gas in Storage Batteries

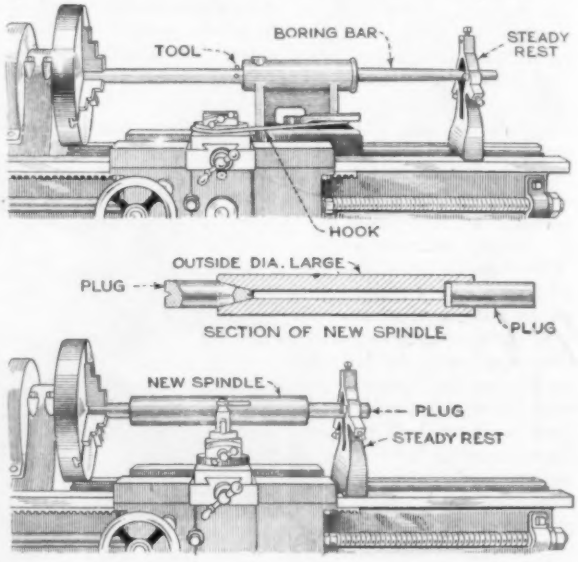
Examining Storage Batteries

Owing to the danger of igniting hydrogen fumes that arise from storage batteries, it is good policy to keep matches, candles and cigarets away. A flashlight is much handier to use for examining the inside of the cells and will eliminate the danger of blowing up the battery and injuring the eyes.

Repairing Lathe Tailstock

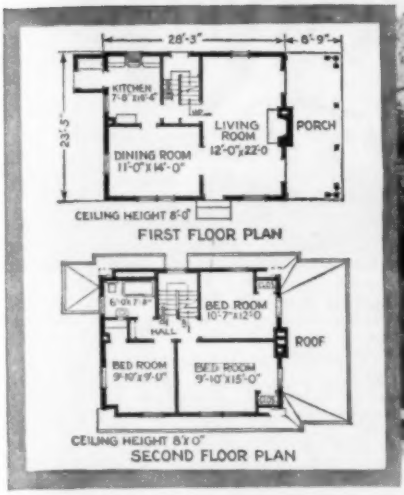
Machinists in small shops are often handicapped when the tailstock spindle of the lathe is worn so loose that it is impossible to clamp it tightly, which gives the lathe a tendency to chatter and makes the work inaccurate. This trouble was remedied by a mechanic in the following way: From a piece of shafting he made a new tailstock spindle just like the old one, except that the diameter was left large enough to fit into the rebored hole. He finished the taper and the seat for the threaded bushing before he started on the tailstock, and prepared long plugs for both ends of the new spindle, as shown in the illustration. He found a boring bar about 3 ft. long, fastened one end in the chuck and ran the other end on the old center, after which he adjusted the steady rest to the bar, close to the outside end. The tailstock was pulled out toward the end of the lathe, and the spindle and the cap in the end were removed. Then the steady rest was removed without disturbing the adjustment, the tailstock shoved up over the boring bar and the steady rest put back in its previous position. Now all that was necessary was some method of feeding the tailstock along while the boring bar revolved. A hook, closely fitted to the tailstock and the carriage, performed this duty. The tailstock clamp bolts were adjusted and the ways oiled so that the tailstock would slide with the carriage without binding. A smooth cut was made through the bore, and this part of the job was done.

He could not use the tailstock for turning now, but he had thought of that in advance when he prepared the plugs for the ends of the new spindle. One of these he held in the chuck, and the other was run in the steady rest having the carriage in between, and although he could not cut from one end to the other, he could turn the surface with two settings of the tool. The diameter was carefully turned to size and filed down smooth, to make a good fit, and the new spindle was lapped into the hole with valve-grinding compound. The lapping had smoothed out all roughness in the bored hole, and gave a slow-wearing surface on both parts.



Worn Lathe Tailstock, Which Gives Lathe Tendency to Chatter and Makes the Work Inaccurate, Can Be Easily Repaired

A Brick-Veneer Six-Room House



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Plan No. 6H4

QUESTIONS regarding home building addressed to this magazine will be answered by the Architects' Small House Service Bureau of the United States, Inc., controlled by the American Institute of Architects and indorsed by the department of commerce, United States government. Blueprints, specifications and material lists for the house shown above may be obtained at a nominal cost. Inclose self-addressed, stamped envelope for reply. If further information is desired send five cents and stamped envelope for a 24-page booklet explaining how the small home bureau functions and showing twelve sample plans.

THERE are types of houses that look cold and formal on the exterior, no matter how cozy they may be within. The Dutch colonial style, however, belongs in the class of houses that seem to be the very embodiment of hominess.

The design shown here has that homelike quality to a marked degree. It is built snugly, close to the ground, and a wide porch, the outside chimney for the fireplace, two sets of French doors opening onto the porch from the living room, all suggest hospitality. While retaining the characteristic low lines of the Dutch colonial style, the roof is pitched so as to provide three excellent bedrooms. Each has a good clothes closet, and light and air from two sides.

The living room runs the full depth of the house. A wide, cased opening joins the corner dining room and the living room. Placing the stairs at the back of the house is not only an economical use of space, but gives them unusual privacy. An open rail could be substituted if desired. A sunroom can be built in place of the open porch if preferred.

This house is planned to be built of brick facing on tile backing, siding being used on the dormers, and with slate roof.

A forty-five to fifty-foot frontage will be required if the house is built as illustrated. If the porch is omitted or built at the rear, a forty-foot frontage would be sufficient. There is a full basement with fuel room, laundry and space for vegetable and fruit storage.

Home Builders' Questions

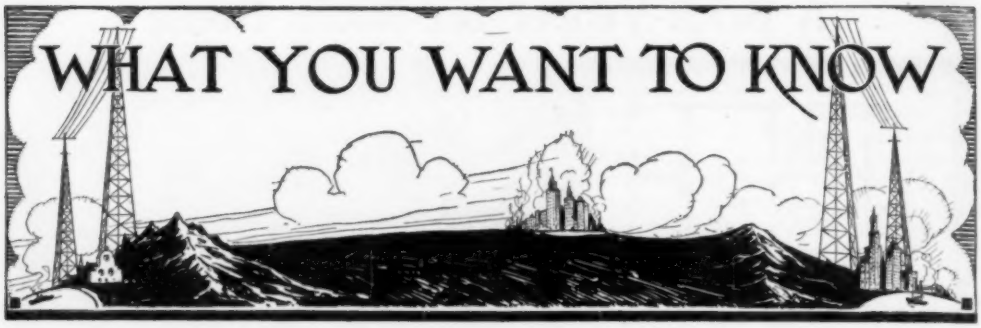
Q. Does painting shingles do as well as dipping them? Is there any advantage in dipping them all over instead of the ends only? A. Shingles that are first creosoted or otherwise wholly impregnated with preservative fluid and afterward painted have the double virtue of durability and of fine appearance.

Q. What is the difference between a sill and a girder, a stud and a bearing post? A. A sill is a heavy timber that goes immediately above the foundation wall. It serves as a connection between the superstructure and the foundation. A girder supports the joists and spans between the posts and sill, or from sill to sill. A stud is a form of column used in framing walls and partitions. A bearing post is generally a column standing alone to support a girder or beam.

Q. We are financing the building of our home on a first mortgage, but we need more money than it is possible to obtain in this manner. To whom should we apply for a second mortgage? What is a fair rate of interest to pay? Do you think it safe to get money in this manner? A. You can obtain your second mortgage from home-financing concerns who make a specialty of this kind of a loan. The rates of interest depend upon how much money you borrow, but the greatest difference lies in the amount of commission that is charged. This may range between five and twenty per cent. Shop around until you get a fair price, but do not borrow money from anybody who has not the reputation for playing square. It is safe to borrow money in this way only if you are able to meet the obligation that you incur to repay.

Q. When erecting a one-story brick house with no basement, must the footings be placed in the ground below the frost line? A. Footings must be run below the frost line. Otherwise the action of frost beneath them may crack the wall. In a compact soil, such as clay, it is more necessary to get well below the frost line than in loose soil, such as sand and gravel.

Stopping Radio Howls—page 835 N.S.E. 25 CENTS



Q. I have a one-tube set using a variocoupler. How can I make this set regenerative? I have a variometer; please show me where to put it in the circuit and oblige. A. The variometer is placed in the plate circuit as shown in Fig. 1.

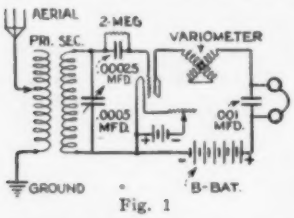


Fig. 1

Q. I have been using a soft detector tube for some time, but would like to change it for a hard tube so as to save the difference on the A-battery drain. Must I change the circuit to use this type of tube? A. You can use a UV-201A or C-301A tube for the detector if you wish. However, when you use this type of tube as a detector, it is best to connect the gridleak to the positive A-battery side, as the tube works better with a positive grid return.

Q. Please send me a diagram for a simple method of connecting the battery charger and set, so that I can use a double-pole, double-throw switch. A. The diagram is given in Fig. 2. A fuse can be placed in the 110-volt a.c. line if desired.

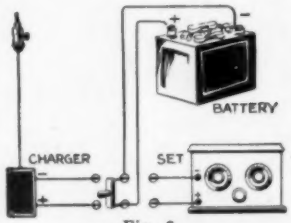


Fig. 2

Q. Can I use two receivers on the same aerial? My friend cannot put up an aerial and I would like to let him use mine, if possible. A. This would not be a good idea, as neither of you would get good results.

Q. Can I build my own B-eliminator for the new Popular Mechanics superheterodyne? I notice that the new 1926 model of this receiver requires 135 volts of B-battery; none of the B-eliminators that I know of deliver this voltage. A. You will find an article in the March issue, containing detailed instructions for building your own B-eliminator. Two types are shown, one for the average set, and another for the new superheterodyne.

Q. I have just finished the new 1926-model of Popular Mechanics Superheterodyne; the potentiometer is rather critical, and if raised very far from the extreme left side, there is a drumming sound. How can I remedy this? A. Place a 1 or 2-meg. resistor in the first input clip of the amplifier unit instead of the .1 supplied with this unit. It may also be necessary to place a .0005-mfd. fixed condenser across the input posts of the amplifier unit.

Q. What effect does a condenser have when placed in parallel with a coil? A. If the condenser is so placed, the wavelength is increased. If placed in series with the coil, the wavelength is reduced.

Q. I have a 100-ft. aerial with a lead-in. of about 25 ft.; does this lead-in wire count in the length of the aerial? A. Yes, the length of the aerial is measured from the extreme end, and includes the lead-in and ground wire. You should reduce the horizontal wire to 50 feet for best results.

Q. What is the best wire for an aerial? Are two or more wires better than a single wire for receiving? A. Use No. 14 copper wire, or standard antenna wire of the stranded type. The ideal aerial wire would be enameled. One wire is just as efficient for receiving as two or three would be; for the average set, a one-wire aerial not exceeding 100 ft. in length gives best results.

Q. I have been told to place a 1 or 2-mfd. by-pass condenser across the B-battery to smooth out the battery noises. I have tried it and the noise was worse than before. Please advise me what to do. A. The by-pass condenser you are using is evidently defective. Try another condenser; a good one will eliminate many of the B-battery noises.

Q. Is it necessary to insulate the ground wire from the set to the ground? A. It is not necessary from the point of efficiency, but a good idea as a protective measure, to prevent shorting of other wires that may come in contact with it. No. 14 insulated wire is recommended.

Q. How far should I be able to receive stations with my five-tube tuned r.f. set? A. Distance depends on several conditions, location, quality, apparatus, atmospheric conditions, and skill of the operator. The average set of the type you mention should have a range of from 1,000 to 2,000 miles under good conditions.

Q. I have a five-tube set of the neutrodyne type and have been getting good results but seem to use up the B-batteries very quickly. The amplifier tubes have to be very bright before I get good results. Can you suggest a remedy? A. Use a 4½-volt C-battery; this will lengthen the life of the B-battery. Also have your tubes tested; they may need rejuvenating or, if defective should be replaced.

Q. Please tell me how the D-coils are wound. I have some 3-in. bakelite tubing and would like to build some of these coils. A. The coil is shown in detail in Fig. 3. The tubing is slotted and the wire is wound on in a figure 8 as indicated.

Fig. 3

Q. What is the cause of fading? Can it be prevented? A. The exact cause of fading has not been discovered. Distant stations will fade and then come in again though the tuning dials are not touched. No remedy has yet been found.

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